ineering
rary

McGraw-Hill Company, Inc.

JUL 23 1923

Engineering News-Record

Devoted to Civil Engineering and Contracting

July 19, 1923

Building Accidents and Their Prevention

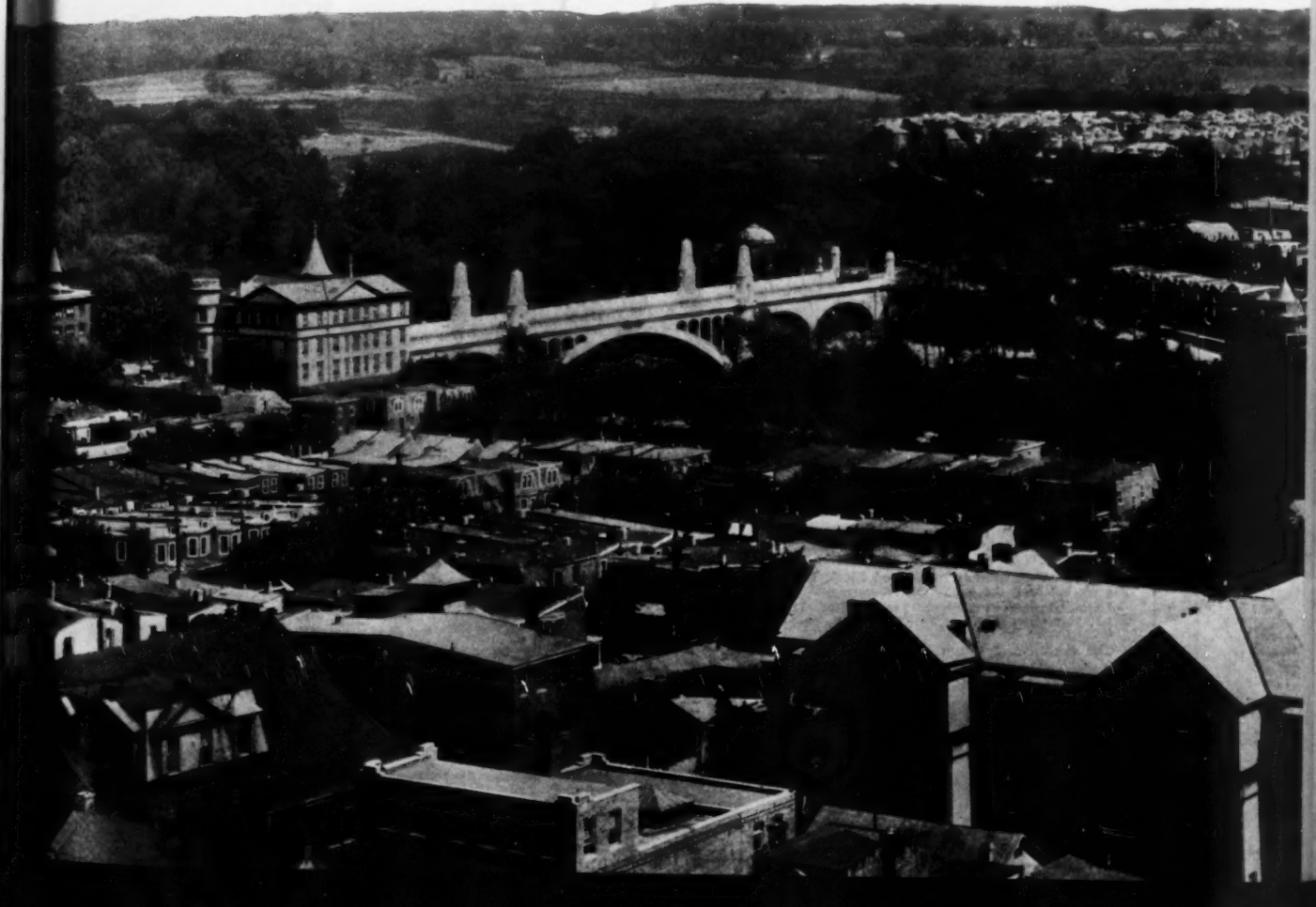
Concrete Memorial Bridge Has Attractive Features

Chicago Council Plans Unified Rapid Transit System

American Society of Civil Engineers Convention Report

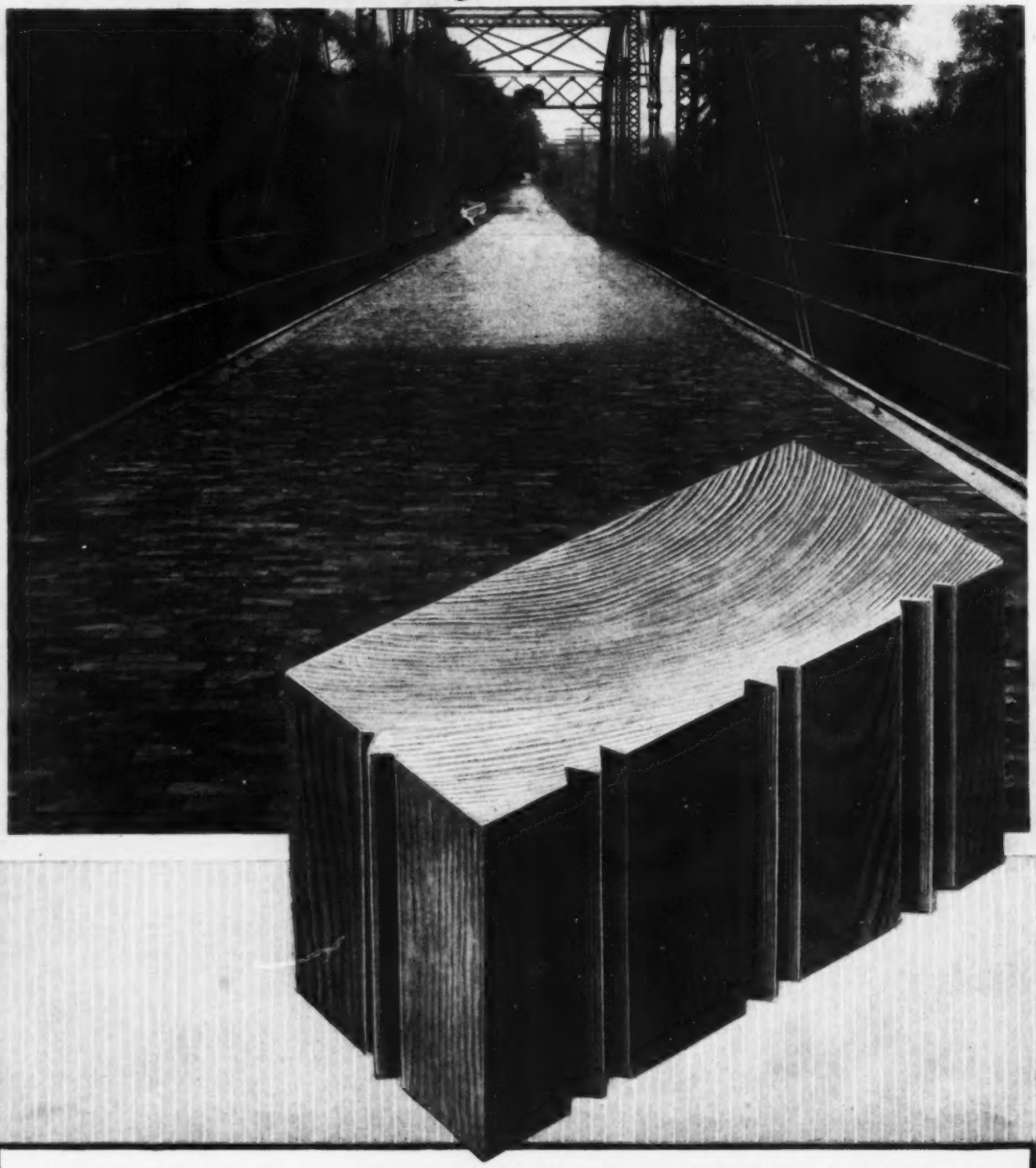
Reviews of Latest Books on Engineering Subjects

Washington Memorial Bridge Across Brandywine Creek, Wilmington, Del



KREOLITE KOUNTERSUNK - LUG - BLOCKS

"The Paving that's Saving"



ABOVE all things, permanence is indispensable to bridge floors.

Kreolite Kountersunk Lug Wood Block Bridge Floors actually grow better under constant use.

Long laboratory research has resulted in the discovery of valuable Kreolite preservatives with which the blocks are impregnated by our patented process.

The exclusive design of the blocks allows openings between them. When these are filled with Kreolite Pitch, the floor is bound securely together, with adequate allowance for expansion and contraction.

In laying, only the tough end grain is exposed to wear.

To all city and county engineers and others interested we extend, gratis, the services of our trained staff of bridge experts.

Write for detailed specifications and information.

THE JENNISON-WRIGHT COMPANY
79 Kreolite Building, Toledo, Ohio

A Consolidation of Engineering News and Engineering Record — McGraw-Hill Company, Inc.—JAMES H. MCGRAW, President

ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

E. J. MEHREN, *Editor*
FRANK C. WIGHT, *Managing Editor*

Volume 91 — NEW YORK, JULY 19, 1923 — Number 3

Work for Engineering Societies

THE resolution on the Davis dismissal adopted by the American Society of Civil Engineers last week is a good start on the campaign of protest that engineers should get going as soon as possible. Washington officials are not altogether deaf to organized expression of opinion, even though it does come from a group so little political minded as the engineers. By the time he gets back from Alaska Secretary Work should have on his desk the protest of every one of the hundreds of engineering societies of the country. This is a situation where mass and distribution will have the most effect. Not only should the Secretary be impressed with the separate protests but each society would do well to take up the matter with its representatives in Congress. It will not do to let this most serious attack on the engineering profession pass by as a mere matter of departmental routine. The politician considers successful any move he can get away with. He banks on popular indifference. Let the engineering profession show that it can defend itself.

Robert W. Hunt

WITH the passing of Robert W. Hunt one of the few remaining pioneers of steelmaking departs. His early work fell in the period when scientific method struggled for recognition in the iron industry, and Captain Hunt did much to hasten that recognition. He will long be remembered, the world over, both for his years of practical activity in the mills, with their fruitful results in the development of working methods and machinery, and for his long, successful career in testing and inspection of mill production. But his memory rests even more securely on the rugged honesty and openness that seemed to mark him as a man among thousands. It is this characteristic which made Robert W. Hunt an inspiration and a force of influence. And surely this same characteristic of his mind was a chief factor in determining his progress and his achievements. The world needs men of his type.

Unified Railway Terminals

THE unification of terminals, or the operation of terminal facilities of different railways in the same city as a unit, for the public benefit, is a problem of recent growth which may assume wide importance, even apart from the problem of railway consolidation with which it is closely related. The concentration of passenger facilities at Portland, Ore., into one station instead of two stations, as described in this issue, is an example of what may be accomplished by co-operation between individual railways and between a group of railways and the city. With all service combined in one union station during war conditions, the advantages to the public were so evident that a proposal to revert to the original two-station plan aroused protest. Conferences between the parties interested resulted in the adoption of a one-station plan which is beneficial to the railways, the city and the public. Freight terminals present a somewhat more complicated problem owing to their greater number and extent, in any one city, but probably there are cases where concentration and co-operation may be applied with mutual benefit, even without complete unification. It is true that in some places, notably in the few very large cities, complete unification is undesirable as tending toward a traffic congestion which latter day municipal planning is trying to avoid, but study of the possibilities of terminal amalgamation would be worth while in most of the cities under a half-million.

To Open Up Alaska

THE visit of the President and some of his cabinet to Alaska doubtless has for its primary purpose the education of those officials, but it should also be quite as important in focusing attention on that much abused peninsula. Newspaper men accompanying the party will see to it that the people all over the country are informed as to the chaotic condition of control in Alaska and the gradually decreasing productivity of a potentially rich territory. Jurisdiction over Alaska is divided among 35 different departments and bureaus of the federal government, most of which center in Washington. A greater measure of self government and of home rule is imperative but what is more necessary is a revision of the excessive application of the theory of conservation which has successfully throttled development. There is need for Congress to reconsider the principles of conservation laid down in the Roosevelt administration, as they apply to Alaska, and to permit judicious private exploitation. Alaska too long has been thought of merely as a source of mineral wealth. It has vast possibilities in other natural resources, notably in timber and pulpwood, and they should be unlocked. The Presidential trip should result in some useful activity in the coming Congress.

Building Accidents Analyzed

AN EXCELLENT piece of analysis has been done by the committee of the New York Am. Soc. C. E. section in its report on the general subject of building accidents reprinted in this issue. Such accidents are sporadic, and they always bring in their train upheavals of public opinion demanding some reform in the condition that caused them. Interest in such reform, however, as a rule soon dies out and conditions remain about as they were before, that is to say, responsibility for safety continues to be left in the hands of an inadequately manned building department, which when accidents do occur can generally be shown to have had very little to do with the failure. The committee's report is an analysis of the causes of building acci-

dents, and a plea for reform of professional organization and attitude, which, it is hoped, will tend to the lessening of such accidents. Specific recommendations toward this end are given, but they reduce to one main idea, that is, that responsibility for the safety of buildings must be centralized on some individual in each building. The committee evidently feels that it is hopeless to expect that law or governmental supervision can insure safe construction. They do feel apparently that a method of licensing might be developed whereby it could be insured that a competent technical direction will be legally insisted upon in every building. Methods whereby such centralized responsibility may be brought about are set forth in the report, which could well be made the subject of study by every local engineering society in the country, with a view to activity in this same direction in each of our large cities. There is plenty of knowledge of how to build safely. The difficulty is in seeing to it that those who do not have that knowledge are kept out of the building business.

Bridging the Golden Gate

DREAMERS have often talked about bridging the mile-wide entrance to San Francisco Bay, the Golden Gate. Occasionally, too, the talk has taken a turn that gave it some measure of popular attention. But never before the present discussion of the subject has the subject been within the range of practical planning and serious business consideration. There is now in existence a very evident purpose on the part of San Francisco to overcome the great handicap of its separation from the counties to the north, and a Golden Gate bridge is no longer the distant dream that it has been at all times in the past.

For a number of reasons, it has never been difficult to draw attention to the idea of such a bridge. The Marin County hills to the north would become a great suburban residential district, with corresponding increase in the value of property there. The West Coast metropolis would gain a direct highway outlet to the northern counties, connecting large sections of country that now have communication over long circuitous routes and giving the densely populated tip of the San Francisco peninsula access to the regions north and northeast—an urgently felt need in these days of dense automobile traffic. Last year something like 74,000 motor vehicles were registered from the 46 square miles of the San Francisco peninsula, which now must travel to and from the city by way of a single route to the south.

The great cost of the bridge project, together with its formidable engineering difficulties, has hitherto stood in the way of its serious consideration. A fear that there might be opposition to a Golden Gate bridge on the part of the War Department has no doubt also been of influence, though so far as known there is no tangible foundation for such a fear. Since the bridge would connect two counties its financing by public funds would present the usual difficulties of inter-county construction, but enormously magnified by the size of the project and the disparity in conditions of the two counties. And as to private financing, the certainty of adequate return on the great cost was lacking.

The inter-county difficulty has largely been swept aside, and the problem of financing thereby largely simplified, by the passage of an enabling act by the recent California Legislature, which authorizes counties to form a bridge and highway district with power to levy assessments and issue bonds for the work they may desire to carry out in co-operation. A committee has already been formed to proceed under this act. The city engineer of San Francisco has drawn public attention to a plan for a 4,000-ft. span across the Golden Gate which it is claimed would cost only $25,000,000. Two other schemes, using a location somewhat inside the Gate and more nearly in the natural line of traffic, would provide even cheaper crossings, and do so by more approved methods, though following a somewhat longer water route. Thus, the elimination of the difficulty of private financing seems to have brought the scheme within the range of practicability at once, and in so doing has served to give new expression to the traffic demands which are ready to support the project.

Thus, another of the country's great bridge crossing problems that remain to be solved is brought into view as an early possibility. The engineering difficulties which it presents are of great magnitude, yet the present resources of the art make them less serious than those of financing. Now that the legislature has made it possible to underwrite a publicly owned bridge, the project is within measurable distance of attainment. Its actual execution, it would seem, awaits only upon the definite determination of the people of San Francisco.

Motor Taxes Are Building the Roads

DESPITE all the arguments of all the automobile-association tax experts the people are assessing the cost of highway improvement on motor-vehicle users. It seems a curious situation. Apparently the car and truck owner, who, as an association member, subscribes to its contention for reduced taxes and their use only for maintenance is, as a citizen, ready to assume increased taxes and to approve their use for original construction when it is a matter of bettering his own traveling conditions. The philosophy of the situation matters little, however, in the face of the facts. These are that over the country the policy is confirmed of raising funds for roads by taxing motor vehicles and the fuel which they consume. A number of states indeed are talking of a tax on tires.

Vehicle taxation for road upkeep is an old practice and ever since they began to be required automobile license fees have been appropriated to road work. Always, however, a general property tax has been considered a main factor in providing money for highways. There is plain indication that the situation in respect to the general tax is approaching a change.

In Wisconsin, for the first time in a purposeful way, motor vehicle users are being taxed not to raise funds primarily for increased road improvements but to relieve present property taxes from a large part of the burden of highway building and upkeep. The new gasoline tax and the new license rates increase by $4,000,000 the taxes which automobile and truck owners must pay. As a result general property taxes will contribute $4,000,000 less toward road construction and maintenance. This is extension of motor-vehicle taxation well in advance of anything undertaken elsewhere but exactly the same trend of thought is being exhibited all down the line of road building states.

In the seven states of the middle south, the Caro-

linas, the two Virginias, Tennessee, Kentucky and Missouri, it is planned to finance an aggregate of $400,000,000 in bonds by motor licenses and gasoline taxes. Not a penny increase in property tax will be asked to pay the interest on and amortize this enormous debt. Texas in recent legislation has doubled the taxes imposed on motor-vehicle users. Indeed in every state but one which last winter took any action on license fees there was an increase in rates.

While there is developing a general increase in motor vehicle license fees, a clearer indication of popular thinking, that the cost of road improvement is the debt of those who operate motor vehicles, is exhibited by gasoline tax legislation. The number of states imposing taxes on gasoline has doubled in the last six months. Recent legislation has, however, shown a strong tendency to impose higher rates. As has been stated, a tire tax, in addition to the gasoline tax, can be foreseen as a possibility.

It requires no further statement of fact to demonstrate that the motor vehicle is being taxed and that it will continue to be taxed and probably the tax rates will be increased instead of reduced. The United States as a whole has embraced the policy of making the motor vehicle user pay for the roads which he uses. And the motor vehicle user is showing astonishing willingness to assume the debt. Indeed there is no longer much force in the railway argument that they are being taxed to build up a rival transportation system which pays no taxes.

Progress in Rapid Transit

UNDER the pressure of growing necessity a number of our largest cities are again taking up actively the development of plans for better city transit. Looking aside from Philadelphia, where one element of the trunk-line subway project developed six or seven years ago is now being put under contract, we find that serious thinking ahead is being done at New York, Detroit and Chicago. Reports made public within the past week in two of these cities show, moreover, that the thinking is independent and energetic. The situation for real progress in rapid-transit development is more hopeful than at any time for a dozen years past.

Of the many ideas embodied in the Chicago report of the local transportation committees of the common council, peculiar interest attaches to that of making elevated railways the chief component of the comprehensive plan. The completed rapid-transit network as projected is to be seven-eighths elevated railway and only one-eighth subway; of the new lines in the network, four-fifths are elevated and only one-fifth subway. This is in striking contrast to what is found in all other rapid-transit planning of recent years, where subways were the principal ingredient.

Elevated railways are cheap, while subways are costly. But a strong prejudice against elevated railways is prevalent, due largely, we believe, to the many offensive features of the noisy, open-floor structures of New York and Chicago. Because of this prejudice the possibilities of better elevated-railway construction have been ignored, with the result that rapid-transit planners have found it expedient to bow to the demand for subways. It was inevitable that the systems so planned would prove enormously costly and that a network of lines extensive enough to carry rapid transit to all corners of an area like Chicago would prove to be a financial chimera. When elevated railways are restored to a more important position in the scheme of rapid-transit affairs, rapid-transit progress will be brought measurably nearer.

A definite aim to distribute instead of concentrate traffic is another feature of the Chicago plan which brings to the front a new idea—new in the sense that though recognized in the past academically, as a very desirable thing, it has rarely found concrete representation in a rapid-transit project. But this and other points of the report which the interested reader will notice may be passed over in the present comment, in favor of another matter discussed in both the New York and Chicago reports, which promises to have great importance, possibly in the very early future. This matter is the relation of the suburban or commuting traffic of the steam railroads to the city transit.

Nowhere has it been possible to extend the municipal rapid transit system far enough to tap the suburbs and take over the commutation traffic developed by the railroad lines. Nor will it ever be possible to do so. The railroads will continue to build up suburban population along their lines and must serve as the twice-daily means of transportation for this population. There follows inevitably a concentration of traffic at the city terminals of the railroads which increases in seriousness as the city grows and which ultimately leads to conditions, in Chicago and New York for instance, that are excessively burdensome and tend to disorganize the whole transportation system of the city.

To remedy this situation a radical cure must be applied. If the railroads are to continue to carry the commuting traffic, and if the concentration of this traffic at single terminals within the city is to be avoided, one of two things must be done. Either the railroads must be extended as rapid-transit lines within the city limits or the suburban traffic must be transferred to the city transit lines at outlying points and distributed by those lines. Local conditions will determine which plan should be used. For Chicago, where the suburban traffic problem is not acute, the report recommends the latter plan as an ultimate goal, to be attained when the excess capacity of the city transit system is sufficient to handle all or part of the suburban traffic. For New York, where the problem is one of immediate urgency, the report considers that as the city transit system is already overloaded with no prospect of growth greater than the increase in the city's demands upon it, the steam railroads should extend their suburban lines to new stations in lower Manhattan.

The problem and its solution are equally obvious. But hitherto the pressure of purely intramural transportation problems has been paramount in virtually every community that has had to deal with rapid transit. Consequently the suburban commuting problem has been ignored, with the rather undesirable result of increasing greatly the concentration of housing within city areas, to the disadvantage of the open and healthful suburban areas. Future development of rapid-transit thinking will, we believe, follow a rather different course. It may even go so far, in some instances, as to make the co-ordination of transit and railroad transportation the controlling element of planning. The emphasis given to the problem by the two present reports assures early progress toward more comprehensive rapid-transit planning.

Building Accidents and Their Prevention

Report of a Committee on Structural Safety in Building, Presented to the New York Section of the American Society of Civil Engineers

After the disastrous collapse of the Knickerbocker Theater in Washington, D. C., on Jan. 28, 1922, which followed only a few weeks after the failure of an uncompleted moving picture theater in Brooklyn, the subject of building failures and how they may be prevented in future was discussed by the New York Section of the American Society of Civil Engineers. At the meeting of Oct. 18, last, several methods tending to improve the safety of buildings proposed by members were referred to a committee, which was charged with a general study of the subject of structural safety in building. This committee, composed of William Cullen Morris, Daniel L. Turner, and F. E. Schmitt, presented a report at the meeting of May 16, most of which is reproduced here.

A thoroughgoing change in present building methods is recommended as the best means of improving present unsatisfactory building conditions. The entire study and the recommendations are limited to building operations of technical character, and do not apply to such simple building work as may be carried out safely by craftsmen without technical direction.

MANY practices in the conduct of building are unsound and unsafe. This condition affects seriously the professional work of engineers as well as the security of the public. Its fundamental cause lies in the fact that incompetent persons are allowed to build, and do build. While this evil is deeply rooted in existing customs, its complete elimination is necessary to place building on a sound basis.

Effective reform rests on practical application of the view that building is a specialized technical activity involving a distinct hazard. In accordance with this view, building should be restricted to persons possessing the knowledge and skill required for carrying it on properly, namely architects and structural engineers. Combining competence, responsibility and authority in one person will effectively guard safety. The proper operation of this system of procedure should, of course, be protected by administrative control by the public building authorities, as a means of enforcement and as a check on full discharge of responsibility. Further, in view of the special position of professional men under the system indicated, co-operation by professional organizations in supervision of its working will be of value.

The subject of safe building is peculiar to no one city but is of nationwide concern and constitutes a single problem. It involves the engineering and architectural professions, the contracting industry, and civic and property interests. If effective reform is to be attained, representatives of all these groups should work together in shaping it and bringing about its adoption. Such a co-operative body should be so constituted, moreover, as to have broad geographical scope and influence. The committee recommends:

I—That the Board of Direction of the New York Section develop a plan for assembling a broadly representative body to devise and promote the adoption of a plan for eliminating unfit persons from direction of building as proposed by restricting it to architects and structural engineers and the practical definition of competence by state licensing; and that the Board initiate the organization of such a body through the Society.

II—That in order to oppose the practise of designing by code and to emphasize the necessity of applying independent technical judgment in design, the Section be asked to express itself in favor of defining a building code as a minimum and to promote the adoption of such definition by statute.

III—That consideration be given to the possibility of establishing continuous professional action on structural engineering matters and on building accidents, with a view to assuring the maintenance of sound conditions within the profession in connection with building, assisting public building administration, and providing for the prompt detection and correction of faults in established technical practices in building.

IV—That, since the architectural attitude toward the responsibilities involved in building affects the corresponding engineering attitude, the Board endeavor to bring about joint consideration of these responsibilities with representatives of the architectural profession.

V—That the special problem of assuring and maintaining the safety of existing buildings, which was not covered by the present committee's work but which appears important, be made the subject of a separate inquiry.

General Building Conditions—Building failures occur under quite varied circumstances. As all such circumstances bear on the value of reform measures or safeguards, the committee sought information on building conditions and examined some 40 failures covering a period of more than 20 years. Of these 40, only two or three can be classed as unpreventable.

In general, the facts establish that building failures are not chargeable to insufficiency of existing technical knowledge, and that the problem of assuring safe building is organizational rather than technical. Safe design and construction methods are known to men skilled in the art, but the actual conduct of building does not always assure that such methods will be used or such men be in control of the work—even in apparently normal practice, as in the Knickerbocker Theater case and some others. Common faults in the direction of building work are: Ignorance of what good building requires, a belief that building codes guarantee safety with ample margin for neglect or variation, dependence on the city building department, neglect of duty, confusion as to where responsibility lies or even absence of responsibility for some part of the work, and often plain cupidity. Technical men are sometimes involved, through incompetence or neglect of duty. It is stated by building officials that sharp practice in taking advantage of inevitable shortcomings of the building law is a factor in unsound building, and that deliberate evasion of the law and even substitution of fraudulent plans for approved plans are known.

Briefly characterizing present conditions of building control, it may be stated that it is possible for a man with no knowledge of building to present plans for a building, to obtain a permit for erecting it, to employ craftsmen, subcontractors or a general contractor of any character, to create public dangers subject only to the objections of a building inspector should such a man chance to become aware of the condition, and finally to put the structure to public use. He may engage an architect or an engineer and may dismiss him at any time—even at a stage when competent supervision is vital—and may direct the work himself. Or, he may in good faith engage as architect or engineer a man who is incompetent, who sells material or who solicits employment on the claim that he can save a few tons of steel over another designer or have a thinner wall

approved by the department, or who is satisfied to represent an important truss by a rough diagram, trusting that proper construction will somehow be obtained.

Remedial Proposals—Several building reform proposals were advanced at the Section meeting of Oct. 18, 1922. The three principal ones are: (a) that of J. B. French, requiring that a structural engineer certify to the safety of any building of public assembly before it is opened to use; (b) that of R. P. Miller, restricting building permits to responsible persons registered with the city building department; and (c) that of L. D. Rights, making the owner legally liable in case he fails to employ a competent architect, engineer and superintendent.

The Miller and French proposals if applied effectively would have been of value under the conditions of some of the recorded failures. In many other failures, however, they would not have made the work safe; additional changes in building methods and control would have been required. The Miller plan, a direct attempt to eliminate unfit persons from direction of building, approaches closely to effective cure of the existing evils but its weakness in failing to provide technically competent conduct of work is vital. Basing the grant of a permit on "responsibility" in place of competence is believed to be open to decisive objections. Yet the plan has the great merit of being the readiest and simplest of the remedies for building evils so far proposed. The committee believes that, however modified, it should include the French plan, which is a necessary element in building reform.

The third proposal, to hold the owner liable for employment of competent men to plan and erect this building, has a fundamentally important purpose. Its practical value depends on the means used to bring about the specified result. No such means have been suggested. The owner's financial liability for damages resulting from failure of his structure, which exists under the common law, is not a sufficiently powerful motive, as past failures demonstrate, and any attempt to attach criminal liability to the owner is believed to be questionable in both its legal and its practical aspects. The principle that safety requires that building work be planned and directed by competent men is not likely to be applied much more effectively than at present so long as the owner is left free to choose. If the principle is valid it is a proper subject for mandatory legislation. The owner's interest will in any event supplement the architect's or engineer's responsibility, since both parties would be subject to penalty. But the primary authority and responsibility for the work must be placed definitely in the hands of the technical man. Any uncertainty on this point will merely perpetuate the present causes of building failures.

Other proposals for guarding against unsafe building, advanced on earlier occasions by various investigating bodies, were also examined by the committee. It appeared that most of them were the response to one particular failure or one set of faulty conditions, and would fail under other conditions. A general proposal to bond every building operation, with evident expectation that the surety would guard the safety of the work, is not believed to be either effective or practically acceptable. Three important proposals are those contained in the report of the Brady-Eidlitz-Just board[1] in 1905, and those made in 1922 by expert committees of the Associated General Contractors and the Washington chapter of the American Association of Engineers[2] after investigating the Knickerbocker theater collapse. Most of their individual recommendations are necessary parts of an adequate system of building reform; the first-mentioned report is particularly noteworthy.

Technical Direction by Public Agency—All thoughtful discussion of building safety has recognized that competent technical direction is the necessary fundamental. Many believe however, that this can be obtained only by governmental agency; in other words, that there is no hope for better building except through more complete plan examination and field inspection by the public department. Even the likelihood that such development would reduce the engineer's and architect's functioning to minor rank does not appear to discourage these opinions. The committee is convinced that improvement does not lie in this direction, and that on the contrary the public supervisory functioning should be adjusted to the purpose of assuring efficient and dependable functioning of the private parties to a building operation. It may be remarked that if full technical guidance of building were to be supplied by the city building department, the cost of carrying it on would be multiplied ten to thirty times, and a quite unmanageable administrative machine would be created.

Provisions for Effective Technical Control—Responsible technical direction of building work with full authority is provided at present in building operations of the higher grade on the initiative of the owner himself, who retains an architect or engineer and leaves this technical man free to work out the problem with full responsibility until ultimate completion and even beyond. Where the system is applied in full, it is entirely effective. The combination of technical competence with complete authority over the work and responsibility for the result represents the basic essential of sound and therefore safe building practice. In the lower class of building work, and especially in speculative building, this system is more or less completely disregarded. The elimination of unsafe building conditions may be brought about by compelling the application to this class of building of the same sound system of building direction that is adopted in high-class building work as a matter of course. While it is true that the owner's interest would even now be served by the adoption of the same system in his work, whatever the kind or grade of building to be constructed, this advantage is not powerful enough to overcome his willingness to gamble against the chance of mishap for the sake of a cheaper result. Legal institution of the system must therefore be resorted to. The method of doing this should, for practical reasons, take account of the weaknesses of present building control.

A list of such weaknesses, compiled largely from the facts of actual failures, is given in the belief that it represents more or less completely the prevailing situation in most cities:

(a) Unauthorized building may go on.
(b) An incompetent or irresponsible person may apply for a permit to build.
(c) The applicant does not undertake to conduct the work and does not assume responsibility for the result.
(d) Plans may be drawn by an incompetent person, or by one not competent in some essential part of the work; plans drawn by a competent person may be changed by an incompetent one; neither designer nor user warrants the adequacy of the plans.
(e) Where structural engineering enters into the plans, this part of the design may be furnished by others than the designer, including material men, without assumption of responsibility and without proper check on its adequacy.
(f) A permit may issue to any one, regardless of competence, and frequently any one may build under the permit.
(g) Permits are sometimes issued on incomplete plans, and even on unapproved plans.
(h) The permit usually imposes no obligation beyond following the building law, and fails to make safe building a condition of the permit.
(i) Competent technical direction of the work is not required.
(j) Difficult engineering operations may be undertaken without engineering direction.
(k) The technical authority is not final, and if the architect's or the engineer's authority on the work is overruled by less competent persons the building department is not concerned.
(l) Inspection by the building department, weak as it is, constitutes the main protection against violation of building law or safe practice.
(m) Control powers as represented by stop orders, suspension or revocation of permit, or special inspection charges, are not always provided or used.
(n) Competent certification of completion in accordance

with the plans, the building law requirements and the demands of safe construction is not made a requirement.

Three of these defects in control, namely (a), (g), and (m), are mere administrative shortcomings, and require no essential change in building control; for example, both police co-operation and prominent placarding of building operations have been found effective in preventing unauthorized building. All the other defects, however, involve either a failure to demand that building be directed with competence, or failure to insist on proper discharge of the responsibility arising out of the work.

A system of technical control devised to meet the conditions indicated by these defects requires the following main provisions:

(A) The conduct of building work is to be limited to structural engineers and architects.

(a) Application for a permit must be made by an architect or a structural engineer. Permit is to be granted only to the applicant, is to be non-transferable, is to stipulate his continuous direction of the work, and is to authorize building only by the permit holder himself or by a registered builder.

(B) Architect and engineer are to be held responsible in design, detailed supervision and inspection of execution for safe conduct and completion of the building operation, and are to be placed in full authority over the work.

(b) Plans for a building must be prepared by an architect or a structural engineer and must bear his personal certification that he prepared the plans, that they conform to the law and that they are adequate for safety. The applicant must certify that he has checked the plans and accepts them as his own. Preferably he should be required to submit proof of the adequacy of the design in its main features, and on demand of the department also of any details.

(c) Application for the permit must include a specific undertaking to conduct the work and assume responsibility for its adequacy until completion. The permit must embody this undertaking.

(d) In all dealings with the work under the permit the department must recognize the permit holder as in charge to make his authority over the work fully effective.

(e) A certificate of completion, adequacy and conformity to plans and law must be rendered by the permit holder, the certificate to be filed of record with the plans.

(C) Engineering competence is to be provided for the design and construction of buildings or parts of buildings involving engineering elements.

(f, g, h, i) Provisions identical with (b) to (e) apply to engineering work, but should be established separately because past failures have shown that there is special danger in indefinite merging or overlap of architectural and engineering responsibility. Personal certification of design is here also essential, regardless of whether the designer is in independent practice, is employed professionally, or is a material man or contractor. Supervision and certification of completion are to follow.

(j) Special engineering work, as difficult shoring or underpinning, requires special direction, and the department must have power to demand such direction at any time.

(D) Means are to be provided for enforcing these requirements through the administrative procedure of the building department, with revocation of permit and assessment of costs on the property as measures of control.

(k) The efficiency of the building department must be increased in order to administer these measures. Its inspection staff should be raised to the architectural and engineering grade.

(l) Control must be improved by requiring the approved plans to be kept on the work, by specific vesting of power in the department to require additional safety measures or special direction, by more careful safeguarding of changes of plan during construction, by use of stop orders, by provision for revocation of permit, and by provision for assessing the cost of all special control proceedings on the property as a lien.

(m) Power must be vested in the department to refuse plans or applications for permits from an architect or engineer who has made himself subject to revocation of a permit.

(n) Registration of builders with the department is desirable for more effective control.

(o) Registration of building supervisors for minor work is a desirable auxiliary.

(E) Competence of architects and structural engineers is to be established by a licensing system.

(F) Revocation of license for cause is to be provided for.

This outline is given not as presenting full working details but as indicating the essentials sufficiently for proper consideration of how building practice would function under mandatory technical control. The actual details should be framed by a body composed of representatives of the several parties concerned, after joint study of the subject. Such study could properly be extended to include a determination of the scope of building control, so as to decide what classes of structures not intended for occupancy affect public safety so directly as to require the same control as buildings.

Defining Competence—The necessary definition of what constitutes a structural engineer or an architect may be attained by state licensing. Licensing alone merely defines the technical man, and cannot materially improve building conditions unless provision is made for placing him in control of building work. The Illinois license and restriction laws for architects and structural engineers seem to be operating fairly well so far as they go; as they protect only design and fail to demand competence in direction of construction they can have only a limited effect.

Supervisors and Builders—Establishment of a separate grade of building supervisor is believed to be warranted only for the proper care of minor building work, and such operations as demolition. Work of definitely technical kind should be directed by the designer or by a man of equal grade who will accept the design on his personal checking and assumption of responsibility. Local registration of building supervisors with the building department is preferable to state licensing, and will facilitate closer check on their functioning. Registration of builders, proposed some years ago by R. P. Miller and endorsed by the Building Officials' Conference, is also considered desirable, less for eliminating incompetence than for strengthening the department's control over building practice by enabling it to place a penalty on the builder who works unsafely or in violation of law.

Professional Co-operation—Certain professional questions are connected with safe building. Since good building depends ultimately on the skill and integrity of engineers and architects, the attitude of the professions will influence the results obtained. When these professions further are established as solely competent to carry on building, the professional status is an even more important subject of consideration. The committee believes that the questions concerned merit careful study. It recommends that professional co-operation in bringing about and maintaining safe building conditions be considered, and suggests three elements of such co-operation: (a) Definition of the professional obligation incurred in engagements connected with building, and provision of means for combating incompetence and malpractice; (b) Formation of local groups or committees to maintain contact with building administration and its problems in the interest of sound building; (c) Provision for current study of building failures with a view to improving technical practices.

Existing Buildings—Representations have been made to the committee that the public confidence in the safety of theaters and halls has been sufficiently disturbed to war-

rant a general inquiry into their condition. While no widespread doubt of this kind is apparent, this fact in itself does not dispel the uncertainties arising from the collapse of the Knickerbocker theater. A general structural survey of theaters and halls by expert committees of professional engineering bodies acting in a disinterested way would constitute an important public service. Because of the magnitude of the undertaking, however, the committee is not prepared to recommend present action.

Quite apart from theaters, supervision of the safety of existing buildings is a matter of growing concern, particularly in regard to buildings of some age, to changed occupancy and to reconstruction. The collapse of the Stratford apartment house two or three years ago carried a warning of the possible instability of old buildings. Public building control faces many difficulties in assuring public safety with regard to existing structures, which rarely are in competent care. The committee believes that the subject should have consideration in any revision of building department functions. It also believes that a separate inquiry into the relation of existing buildings to public safety is desirable.

Appendices

Analysis of Building Failures—Analysis of numerous building failures with respect to the individuals at fault showed that each one of the typical parties to a building operation has been responsible for one or more failures, but owner and architect by far most frequently. Often no supervision was provided, and this is chargeable to the owner; the list of owners thus at fault includes responsible, well informed individuals and corporations. The entire history of failures as well as the experience of building officials reveals a widespread lack of appreciation, on the part of non-technical owners, of the essentials of safe procedure to assure proper technical results.

Where architectural supervision was provided, it was in some cases plainly superficial and ineffective, serving as a check on the contractor's bills rather than as a safety measure. This is charged against the architect as a fault. The same applies to cases in which the architect did not provide the necessary engineering skill for design and supervision of structural engineering phases of the work. Correction of these faults must be sought through definite assignment of responsibilities and through a clarification of the question of what constitutes adequate performance of a professional engagement.

A study of the part played by the separate functions or agencies which enter into building work led to the following conclusions: (1) Deficiencies in building codes cannot be charged with any material part in failures, though the complexity and great detail of codes has often been confusing and even misleading to a dangerous degree. (2) Bad designing has caused many failures, due variously to incompetence, negligence, failure to provide sufficient detail in the design, failure to engage an engineer for needed structural or foundation design, improper delegation of parts of the designing to material men and others who did not assume effective responsibility and whose designs were not checked. (3) Plan examination, while often inadequate, has not been directly responsible for any failures, though it has contributed to some. (4) Loose control of authorization to build is a marked source of danger in some cities and produced one recent failure. (5) The grant of building permits is not limited to persons competent to carry out a building enterprise. (6) The form of contract does not appear to be related to safety, as instanced by the fact that at least one failure occurred in a cost-plus contract. (7) The practice of the owner subcontracting direct is highly hazardous. (8) Bad work by the contractor is a minor though not negligible factor. (9) Supervision of building, though vital to safety, is almost always absent or is of superficial character in that class of building which is recognized by building officials as troublesome or dangerous and which has contributed many items of the failure record. (10) Municipal inspection is so inadequate as to afford little protection in case of faulty performance by the private parties.

More generally, it appeared that the organizational system and precautions applied in general construction work, and found to be adequately safe there, are frequently absent from building. The control by public building departments does not insist on their being provided, but dependence on that control appears to be one motive for not providing them. It is obvious that a system similar to that used in general construction would assure safe building, through its centralization of authority and responsibility in a technical competent person.

Differences of location and time were found to be unrelated to the results of these analyses, but all the data gathered, including the facts of the earlier failures, proved consistent in respect to underlying conditions. Building departments differ in excellence, and most of them have improved steadily, so that some cities now have substantially as good building administration as is to be expected under present functions and powers. On the other hand, building is growing more complex, and its demands on the ability and integrity of technical men are increasing. This development appears to be proceeding more rapidly than the gradual improvement of practice, especially in view of the spread of difficult and hazardous building to smaller communities, where the protection of public safety in building is least efficient. All things considered, the problem of structural safety appears to be growing more critical, rather than the opposite.

The Building Department—Proper organization of work in the degree found necessary in other construction is commonly thought unnecessary in building, partly because the work is looked upon as non-technical and simple, but partly because of the dependence placed in the municipal building department for ultimate safety. This dependence is apparent in the attitude of press and public toward building questions, and even in that of many technical men. It involves a belief that engineers, architects and builders are fallible but the building department's plan examination and field inspection protect or ought to protect the public. Unfortunately, also, the daily work of building officials shows much fallibility, negligence and incompetence, and violation of law, on the part of persons who propose to build. The official of one large city states that every set of building plans submitted to his office requires to be changed before it can be approved.

Dependence on the building department for safety is not warranted by the facts. Further, the function of the department, a policing function, is to inspect rather than supervise and direct building work. When the parties who engage in building rely on the department to assure safety, their own sense of responsibility largely disappears, and it is found especially in purely speculative operations that the municipal plan examination and inspection reduce by as much or more the care and conscientious effort of the designer as well as of those who should provide direction and supervision of the work. It enables these private parties to transfer some of their work and duty to the department, and the opportunity is extensively taken. The Knickerbocker theater collapse was a consequence of improperly guarded transfer of responsibility by the designer to other parties with final dependence on the building department. Any method proposed for improving building practice which does not furnish a fundamental corrective for this condition is certain to prove a disappointment.

Most building departments are heavily overburdened, and operate in reasonably satisfactory way only by virtue of hard work on the part of overtaxed and underpaid examiners. There is some evidence that this condition is becoming more serious. Plan examination is superficial at best, often being done by a process of sampling. In smaller places cases are known where the building official is not competent to pass on plans for other than the most simple building work, and approves them without examination. Field inspection as now conducted is in some degree a check on conformity to the law, but it cannot be regarded as an important assurance of safety. In short, building departments do not fully examine plans and do not fully inspect. To do even their present work properly, however, they are in urgent need of improvement both in quality and in size

of office and field staff. Vastly greater improvement would be required to fit them for carrying the full responsibility of safeguarding building, were this result at all practicable.

The building department should not assume any part of the duty to provide technical knowledge and skill to the building operation. This duty clearly rests on those persons who engage in the operation, and the department should confine itself to its obvious charge of enforcing and supervising the responsibility of the builders.

Building Codes—Building codes, commonly held to be important instruments of safety, appear to have been developed to a degree of elaborateness of detail which operates to the detriment of safety in some instances. They are usually specifications that attempt to cover all elements of building construction. Many designers use them as their sole guide. "Building code designing" has become a byword, and its effects appear in a number of past failures.

Complete specifying of sound practice is impossible in the field of building as it is in other fields of construction; yet the view prevails even among architects and engineers to some extent that any design which can be interpreted as complying with the building code is safe, relieving them as designers from further responsibility. It seems desirable to emphasize the danger of this view by defining the code as a set of minimum, not necessarily sufficient, requirements, and by charging the designer with responsibility for safe designing regardless of the minimum fixed by the code. The department then should have discretionary power to reject plans and to stop work even though conforming to the code and the plans. Its work would be assisted if designers were required to present affirmative proof of the sufficiency of their plans, rather than that the department should bear the burden of disproof.

The detailed codes now current are known to be burdensome to the capable and conscientious designer while at the same time they are not adequate to prevent bad design. Simplification of codes therefore is a desirable improvement. However, it is by no means as vital to building safety as the revision of building control, and for the present purpose may be disregarded as secondary.

Uniformity of codes has been much discussed, apparently in the belief that it is both a safety and an economy measure. The present study has not indicated any relation between the safety of building work and uniformity or variation of codes. It seems likely that uniform codes would have some advantage in the way of convenience to users; they are not believed to promote safety.

Professional Relation To Building Safety—(a) Many building failures have brought to light undesirable professional conditions. Professional incompetence has repeatedly been recorded. In other cases, sometimes perhaps under the pressure of low fees or excessive expense, there has been obvious neglect of part of the professional man's duty to assure safe completion of a piece of work that he has entered upon, as by failure to give supervision in the field, or by inadequate supervision.

No standard appears to exist by which the professional duty assumed in any case may be determined. Commonly the terms of employment are considered to limit the obligation, so that a designer frequently sells plans, or inspects the execution of his design only superficially. While legislative defining of responsibilities would tend to clarify the situation, it is desirable that professional standards be superior rather than inferior to the law's requirements.

(b) The public and the profession have a joint interest in protecting the system of public building administration from the various harmful influences that work against its efficiency. Professional co-operation with the building department would be of distinct service in combating the exercise of political pressure to weaken the forcefulness and impartiality of building law administration, the grant of violation permits by city councils, ordinary deterioration of the department, the effects of obsolescence of the code, and other causes of unsatisfactory building conditions.

(c) Some building failures have revealed imperfections in technical knowledge of building work, or in current technical practice, which have had to wait for their removal on the slow process of amending the building laws or else on spontaneous general change of practice. The prohibition of cast-iron column construction for high buildings and the elimination of faulty practice in reinforced concrete, for example, came about slowly in the absence of professional action on a series of failures. Service to the community obligates the profession to undertake on its own initiative the prompt study of points of imperfection revealed by structural accidents. As a prerequisite to such study the technical facts of failures need to be determined by current investigation of failures as they occur.

It is believed that means for dealing with these questions continuously should be provided by professional action.

---

[1]Abstracted in *Engineering News-Record* of March 30, 1922, p. 532.

[2]After a series of flat-house failures in New York City in March, 1905, a board consisting of Thomas J. Brady, Otto M. Eidlitz and George A. Just recommended to the borough president of Manhattan, New York City, that (a) architects be required by law to supervise the construction of buildings for which they furnish plans; (b) the competence of architects be assured by some system of license or registration; (c) permits be issued only to persons so registered; (d) mason and structural contractors be licensed; (e) work by persons not licensed be declared unlawful. These recommendations were reproduced in *Engineering News* of April 13, 1905, p. 391.

Suggestions for Engine Terminal Improvement

DESIGN of locomotive terminals was treated from three different points of view at a meeting of the Western Society of Engineers recently. R. N. Begien, then general manager of the Baltimore & Ohio R.R., discussing the operating requirements, laid stress on the economies resulting from greater service and fewer locomotives when there is rapid handling of the engines in cleaning fires and taking coal and water so as to make ready promptly for another trip. For the design of an efficient terminal, knowledge of operating conditions and terminal work is an essential supplement to engineering knowledge. The mechanical and engineering requirements were discussed by L. K. Sillcox, general superintendent of motive power of the Chicago, Milwaukee & St. Paul Ry., and W. T. Krausch, engineer of buildings, Chicago, Burlington & Quincy Ry.

Mr. Sillcox analyzed the time consumed in "turning" an engine, that is, in making an inbound engine ready for an outbound trip. This time averages 11¼ hr., but detentions increase the delay to 16 hr., so that a locomotive averages only 8 hr. of service per 24 hr. Increase of this period may be obtained by wider and better spacing of terminals in order to give longer runs, or by improving the facilities for handling the engines at terminals. He emphasized the fact that increase in capacity and equipment of roundhouses has not kept pace with the increase in number and size of locomotives to be served. As an instance of the economic aspect, he explained that if the average frequency of turning could be reduced to 1.3 times per day instead of 1.4 times, as at present, with a reduction of 50c. in cost of terminal service per engine turned, the annual saving on 2,000 locomotives would be about $650,000, which at 10 per cent for interest and fixed charges would support an investment of $6,500,000.

On the engineering requirements, Mr. Krausch said that in many cases an existing terminal can be so improved at moderate cost as to increase greatly the efficiency and economy of its work. In other cases it is economy to plan new terminals on new sites. He emphasized particularly that the only way to get improvement in operating results is for the engineering, mechanical and transportation department to: "Get together, stay together and pull together."

Experiments in Water Coagulation with Aluminum Sulphate

Relation of Hydrogen-ion Concentration to Precipitation and Dissolution of Aluminum Hydroxide

By F. E. Daniels

Assistant Engineer, Chief Chemical Laboratory, Engineering Division, Pennsylvania Department of Health, Harrisburg, Pa.

Hildebrand, Blum[1] and others have made studies of the precipitation of aluminum hydroxide using the hydrogen electrode to measure the reactions involved. Buswell and Greenfield[2] and Buswell and Edwards[3] have studied the precipitation of aluminum hydroxide on a filter-plant scale, and give data showing that its precipitation and resolution depend, in a large measure, upon the hydrogen-ion concentration. Studies made by the Virginia State Board of Health also show that this is true, but that the conditions for optimum precipitation depend upon the organic content of the waters and other available factors.

The purpose of this paper is to give experimental data showing the influence of the hydrogen-ion concentration alone upon the precipitation and dissolution of aluminum hydroxide, using a dilution and temperature comparable with those found in a filter plant. A dilute solution of aluminum sulphate was precipitated, (1) with varying amounts of sodium carbonate and (2) with varying amounts of calcium hydroxide. Hydrogen-ion concentrations were determined colorimetrically in the solutions containing the precipitates. Color standards were prepared using buffer solutions whose strengths were determined by electrometric titrations. The precipitates were filtered, ignited and weighed as Al_2O_3.

The table accompanying this article gives the amounts of aluminum as aluminum oxide precipitated from 500-cc. solutions of aluminum sulphate. Curves were plotted giving the hydrogen-ion concentrations as ordinates and the parts per million of Al_2O_3 precipitated as abscissas. Using aluminum sulphate and sodium carbonate, the maximum precipitation occurred within the zone whose limits of hydrogen-ion concentrations were approximately from pH 6 to pH 7. In solutions more alkaline than pH 6.8, dissolution of the hydroxide as the aluminate began and continued with increasing alkalinity until the entire floc was redissolved at a pH of 10.5.

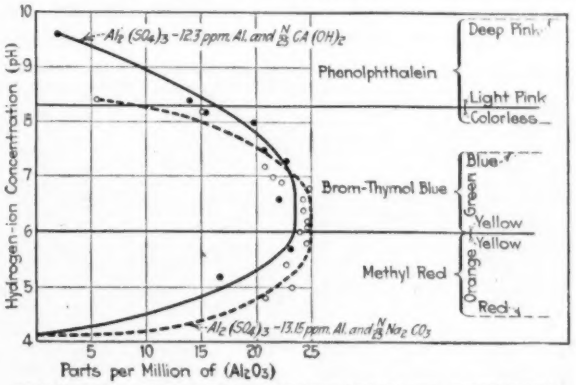
Alumina precipitated at the pH indicated from solutions of aluminum sulphate containing 25 p.p.m. alumina.

Na_2CO_3 and $Al_2(SO_4)_3$		$Ca(OH)_2$ and $Al_2(SO_4)_3$	
pH	Al_2O_3 P. P. M.	pH	Al_2O_3 P. P. M.
4.8	20.8	5.2	16.6
5.0	23.2	5.7	23.2
5.4	22.8	6.6	23.0
5.8	24.8	7.3	22.6
6.1	24.8	7.5	20.6
6.2	24.8	8.0	19.6
6.4	24.4	8.2	15.4
6.6	24.4	8.2	15.0
6.8	24.8	8.4	14.0
7.0	21.6	9.6	2.0
7.2	20.8	...	....
7.4	18.4	...	....
8.2	15.2	...	....
8.4	5.6	...	....

As the calcium aluminates are less soluble than the sodium aluminates, dissolution of the precipitate formed from calcium hydroxide did not begin as soon as the dissolution of the hydroxide formed from sodium carbonate. At a hydrogen-ion concentration of about 7.3 the maximum amount of hydroxide was still precipitated with $Ca(OH)_2$. Anything more alkaline than this, however, caused the soluble calcium aluminates to form.

It is of interest to note that with either curve the inflection points showing the beginning of dissolution occur before a hydrogen-ion concentration of 8.3 is reached. At this point phenolphthalein changes from colorless to pink. It is occasionally the practice in filter plant operation to control the precipitation by means of this indicator. From the figures published in this article it is quite evident that a pink color with phenolphthalein shows that the water is alkaline enough to dissolve part of the aluminum hydroxide, and more so in the case of sodium carbonate than when lime is used.

Brom-thymol-blue begins to change from yellow to blue at a hydrogen-ion concentration of 6.0. As the number of hydroxyl ions increases, formation of the blue color begins and gives a series of shades of green as the blue becomes more and more predominant. The dye is blue at a pH of 7.0 but intermediate tints of blue can be recognized until 7.6 is reached and the dye is completely blue; and then no further addition of alkali can change this color. By adjusting the alkalinity of the water until a tint of green color is reached with this indicator, it is possible to obtain the optimum zone for the precipitation of aluminum hydroxide. This results in economies in filter plant operation, in a water free from soluble aluminates and in a reduction of the corrosion of pipes.



RELATION OF H-ION CONCENTRATION TO PRECIPITATION AND DISSOLUTION OF ALUMINUM HYDROXIDE

Although the curves show that the residual reaction of the effluent should be on the acid side of neutrality to obtain the maximum precipitation of alum, there is an important reason why the filtrate should be alkaline. A bicarbonate alkalinity having a pH in the neighborhood of 8 or 9 is very much less corrosive than a more acid water, as the excess bicarbonate acts as a buffer and prevents the CO_2 from attacking iron. If it is desired to secure a water of such alkalinity, it should be secured by adding lime or soda after filtration, as has been done recently in Baltimore (*Engineering and Contracting*, Aug. 9, 1922).

The author wishes to ackowledge and give credit to Edward Martin, M. D., C. A. Emerson, Jr., and W. L. Long, who, at the time the above work was done, were respectively commissioner, chief engineer and chief chemist of the Pennsylvania Department of Health.

References: [1]W. J. Blum, Am. Chem. Soc., Vol. 30, p. 1,282 (1916). [2]A. M. Buswell and G. P. Edwards, *Chem. & Met. Eng.*, 26-826 (1922). [3]R. E. Greenfield and A. M. Buswell, *Jour.* Am. Chem. Soc., 44-1435 (1922).

Passenger Terminal Improvements at Portland, Ore.

To Secure Joint Terminal City Vacates Streets and Railways Give Land for Widening Streets—Terms of Agreement

CONSOLIDATION of all railway passenger business in one union station at Portland, Ore., and the abandonment of a second terminal station, has necessitated not only material alterations and improvements in the railway terminal facilities but also extended negotiations with the city in regard to vacation of streets for railway purposes and the donation of certain railway property to the city. The general situation is explained by the plan, Fig. 1.

The principal passenger terminal is the union station at Broadway and Hoyt Sts., built in 1894 by the Northern Pacific Terminal Co., which is owned jointly by the Northern Pacific Ry., Southern Pacific Ry. and Oregon-Washington Railroad & Navigation Co. In 1906, the Spokane, Portland & Seattle Ry. built a smaller station at Eleventh and Hoyt Sts., and this was used also by the Great Northern Ry. During the period of federal administration of the railways the two latter lines were diverted to the union station, but when the railways were returned to private ownership the Northern Pacific Terminal Co. notified these new tenant lines that it would be unable to accommodate them.

This proposed separation of railway terminals led to protest on the part of the city and various civic organizations, coupled with a demand for more adequate facilities, on the ground that public convenience would best be served by a single but larger terminal station. As a result, a joint study of general improvement of both the passenger and the freight terminals was undertaken in 1920 by the several railways.

Revision of Terminals—A serious obstacle to expansion of the union station trackage was the existence of the Terminal Co.'s freight yard and engine terminal alongside the passenger tracks. After the study of the situation it was decided to provide a new freight yard and engine terminal outside the city and about two miles northwest of the union station. The first unit of this new freight terminal, known as the Guild's Lake yard, was completed in 1922, a large amount of filling being pumped in from the river by hydraulic dredges to form the site. With the ground at the passenger station thus cleared it was possible to provide at once two additional passenger tracks with a 19-ft. platform 1,600 ft. long. The remaining space was utilized for a local freight yard having team tracks, automobile loading platform, track scale and a crane for handling heavy freight. There is room also for another platform and two more passenger tracks when required.

In addition to team track purposes, this yard is used for receiving and delivering transfers of the three railways owning the Northern Pacific Terminal Co. This latter company does not move cars to and from the yards of the trunk lines, but it does handle all switching business for tenant lines and has joint use of a double-track line between the passenger and local freight terminal and the new outlying Guild's Lake yard.

At present all the lines are using the union station and the traffic averages 48 inbound and 48 outbound scheduled trains daily, about twenty of these being local electric trains of the Southern Pacific Ry. to and from Willamette Valley points.

As now enlarged the station has four 19-ft. platforms 1,100 to 1,330 ft. long, connected by a 60-ft. transverse concourse opposite the headhouse, as shown in Fig. 2. Umbrella roofs cover the platforms for lengths of 150 to 300 ft. and over the concourse is a high shed roof. These platforms serve nine through tracks and four stub

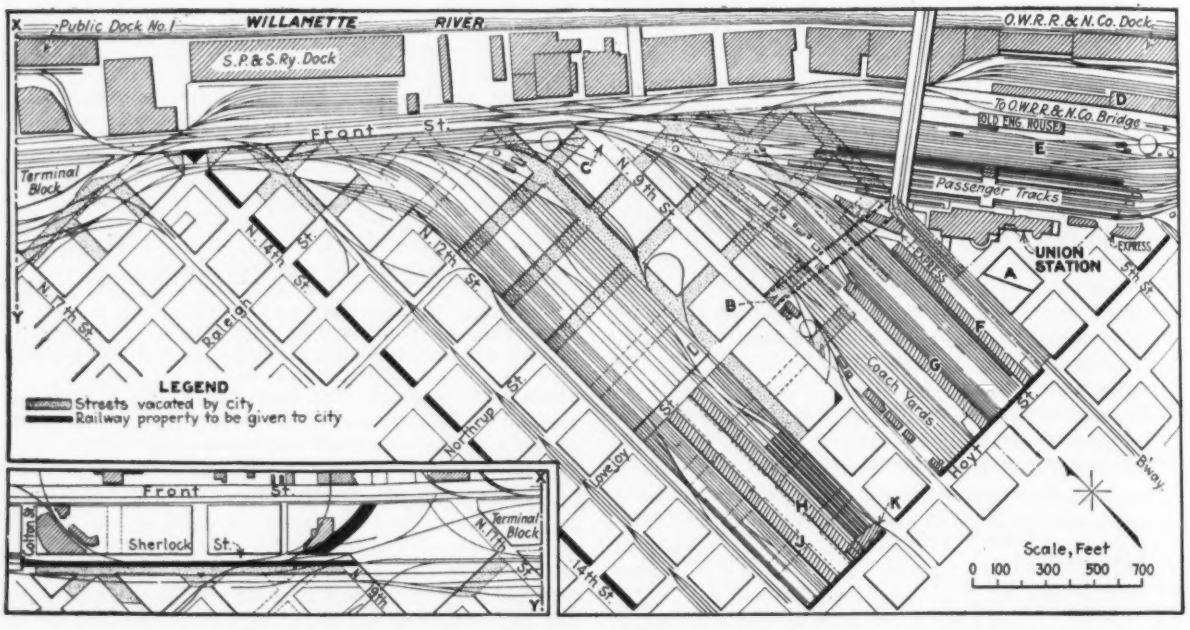


FIG. 1—IMPROVEMENTS FOR RAILWAY TERMINALS AT PORTLAND, ORE.
A, block for parking space. B, new viaduct to Broadway Bridge. C, new viaduct on 9th St. to cross Front St. D, freight house of O.-W. R.R. & N. Co. E, old freight yard and engine terminal of Northern Pacific Terminal Co. F, freighthouse of Northern Pacific Ry. G, freighthouse of Southern Pacific Ry. H and J, freighthouses of S., P. & S. Ry. K, old passenger station of S., P. & S. Ry. Improvements in freighthouse facilities are to be made in 1924.

tracks, the latter being for baggage, express and private cars. Provision is made for a fifth covered platform and two additional tracks, replacing three of the present freight tracks. Entrance to the station is to be improved and the block opposite the headhouse will be developed for parking purposes and as part of an attractive approach. A new station building will be erected eventually. During 1923 there will be expended about $150,000 in track changes, street improvements and other work involved in the recent agreement between the Terminal Co. and the city.

Extensive improvements in freighthouse facilities and the local freight yard adjacent to the passenger station are contemplated, but these plans are not yet completed. Coach cleaning and storage tracks are now arranged along 9th St. north of Hoyt St. (see Fig. 1), but the second unit of the outside freight yard at Guild's Lake will provide a new location for these facilities, the space then vacated being utilized for freighthouse purposes. It is expected that this second unit will be built in 1924.

Viaducts and Street Widening—Since streets and railway tracks are at the same level, both street and railway traffic will be facilitated by the construction of viaducts carrying streets over the tracks at certain points. A viaduct along 9th St. and crossing the tracks at Front St. is to be built within three years. A viaduct crossing the terminal tracks will form an extension of Lovejoy St. from 12th St. to the Broadway Bridge over the river, an easement for this structure being granted by the terminal company. This will provide a new approach to the bridge, at right angles with the present inclined approach on Broadway, beginning at Hoyt St. The present street beneath this incline will be vacated, as shown. Another viaduct for pedestrians will extend from the station to the bridge.

Street widening is an important part of the general terminal improvement project. When the city widens 14th St. from Hoyt St. to Front St., the railroads will dedicate a 20-ft. strip of land from their properties. For the widening of Hoyt St. from 4th to 14th Sts., after three years from the date of agreement the railroads will dedicate a 10-ft. strip when the city undertakes the work and acquires the other necessary property from private owners. On Sherlock Ave., the city will vacate the west side for use by the railroads and in return the railroads will dedicate a 20-ft. strip along the opposite side, as well as a 50-ft. strip for a connection to Front St., as shown in Fig. 1.

Vacation of Streets—Improvements in railway terminal facilities at Portland have been hampered by the fact that a large part of the area occupied by passenger and freight facilities of the Northern Pacific Terminal Co. and individual railways is laid out in streets and blocks. With city ownership of strips of land designated as "streets" extending across railway property, the railways have been at a disadvantage in developing their property, although they owned most of the land in the "blocks." Negotiations with the city authorities were started, therefore, in order to secure the vacation of these obstructive "streets" as an offset to public benefits resulting from improvements made by the railways.

For many years Portland has had a restriction in its charter prohibiting the city from vacating streets in areas near the railway terminals or the river, the purpose of this being to prevent private interests from shutting off public access to the river front. In view of the existing situation, however, the negotiations resulted in the approval of plans submitted by the railways, and a charter amendment removing the restriction as to certain specified sections of streets, with an aggregate area of 658,000 sq.ft., was passed by public vote in June, 1921. This extensive exchange of property is indicated clearly by Fig. 1. On the part of the railways the principal features of the agreement with the city, as adopted on June 20, 1922, are as follows:

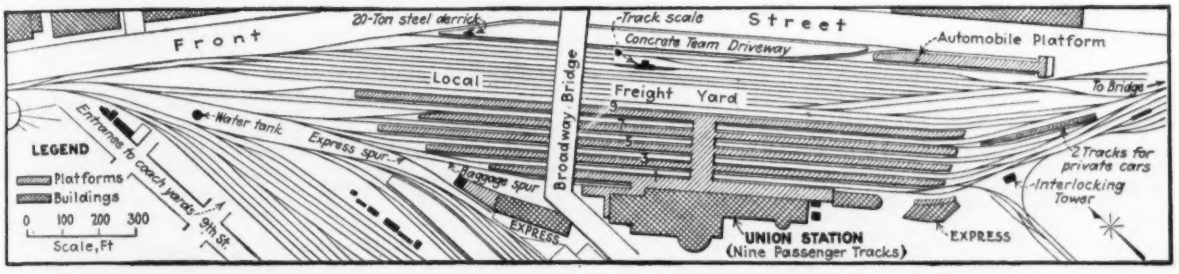


FIG. 2—PASSENGER STATION AND CITY FREIGHT YARD OF NORTHERN PACIFIC TERMINAL CO., PORTLAND, ORE.

1. Provision of adequate terminal facilities for both passenger and freight traffic.

2. Dedication to the city of certain railway property needed in future street widening. There are seven widenings in all, but mainly along Hoyt St. and 14th St., and on Sherlock Ave. from 19th St. to Colton St., where the west side of the street will be vacated for railway purposes as noted above.

3. Permission for continued use and maintenance by the city and public service companies of sewers, water mains and other public utilities in the vacated streets, the railways assuming responsibility for damages to these utilities resulting from the changed use of the property.

4. Agreement to pay for the paving of certain streets not vacated in the terminal district, when required by regular street improvement proceedings.

5. Agreement to pay proportionate shares of the cost of the viaducts over the railway tracks at 9th St. and Lovejoy St. when these improvements are initiated by the city. About 80 per cent of the cost of one of these viaducts will be paid by the railways, since the charter apportions 20 per cent of the cost to the city, 20 per cent to the abutting property owners (which are the railways) and 60 per cent to the railways affected.

6. Removal of longitudinal tracks in Front St. so as to leave a width of at least 60 ft. free from tracks. Repaving will be done by the railways. This is an 80-ft. street having docks, elevators and manufacturing plants on the river side and railway property on the opposite side. As a result of the agreement between the railroads

and the city, Front St. is being improved with a 10-in. reinforced-concrete pavement, the relocation of tracks and the installation of safety islands for a line of steel poles. This improvement extends from Glisan St. north to Nicolai St., about 1½ miles, and its cost is estimated at $240,000.

7. Improving a vacant block in front of the union station to provide adequate parking space for automobiles and giving the city control of the parking on the northeast half of the block (see plan) until such time as it is required for railway purposes.

Under the terms of this agreement the railways are to carry out the main part of these undertakings within three years, or before July 24, 1925. In the negotiations and preparation of plans, each of the five railways had its representatives. The city was represented by O. Laurgaard, city engineer, and the Northern Pacific Terminal Co. by A. E. McKennett, chief engineer. The railway improvement work is carried out under the direction of Mr. McKennett, while the street improvements, viaducts and track work in street areas will be done under the direction of the city engineer.

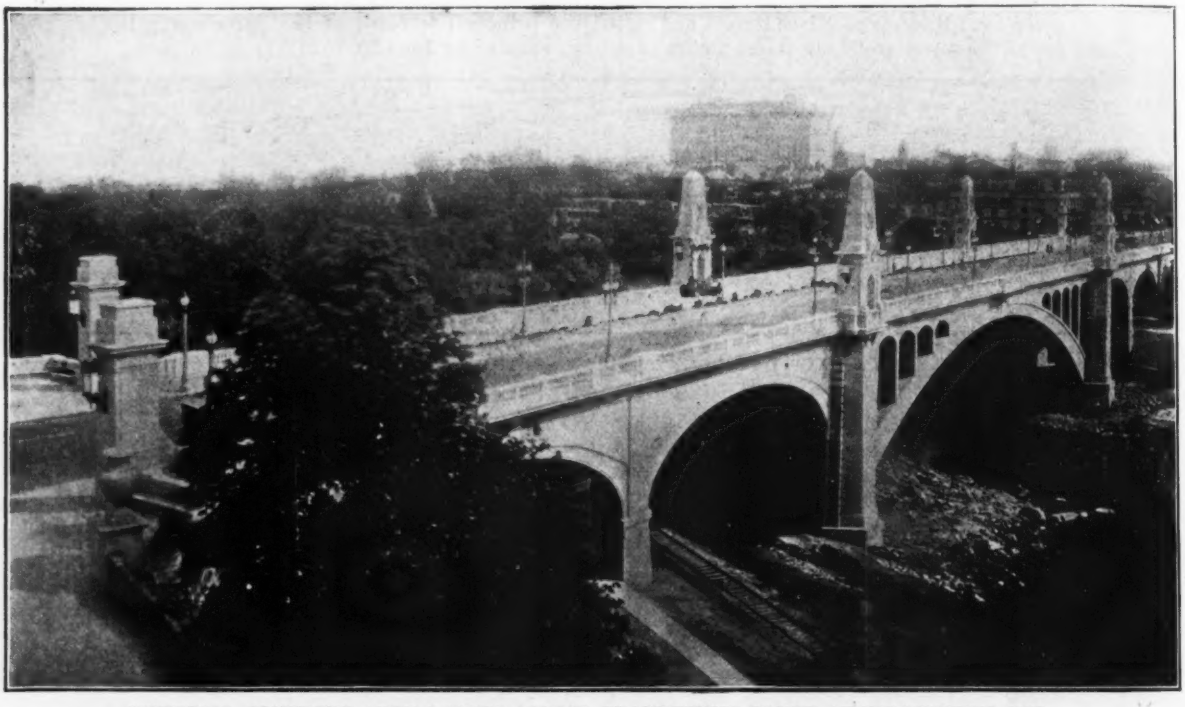
To Unify Segments of Intercoastal Canal

Col. George M. Hoffman, the district engineer for the War Department at New Orleans, has submitted a preliminary report on the whole intercoastal canal project between New Orleans and Corpus Christi, Texas, and has recommended a survey with the idea of unifying the various segments which make up the waterway. The The barge line operations on the Mississippi River, together with the purchase by the Government of three private canals which allow the free use of the existing segment between New Orleans and Morgan City, has greatly stimulated the desire of the communities further west to have the advantage of through traffic.

Concrete Memorial Bridge Has Attractive Appearance

Washington St. Bridge at Wilmington, Designed as Memorial to Delaware Soldiers, of Pleasing Line and Surface

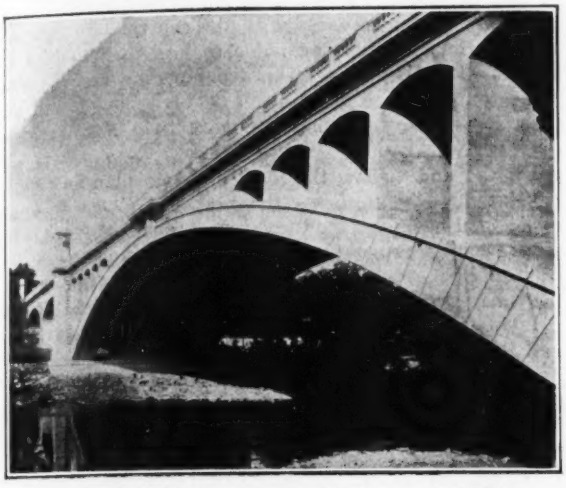
ONE of the most attractive of the several bridges which have been built as memorials to those who served in the World War is the Washington Memorial Bridge across Brandywine Creek and its valley in Wilmington, Del. The structure is a necessary element in the street plan of the city and the memorial features were added after its initiation at an added cost of about $56,000. Final cost of the whole project was $823,000. In keeping with the nature of the bridge special attention was paid to the architectural design, to make it fit more into the park-like nature of the surroundings, and memorial pylons were added bearing the names of all those from Delaware who died in the World War as well as the names of the engagements in which Delaware troops were engaged in all of the wars of the United States.



MEMORIAL CONCRETE ARCH BRIDGE ACROSS BRANDYWINE CREEK AT WILMINGTON, DEL.

The bridge is 720 ft. long and 72 ft. wide and consists of five reinforced-concrete arch spans; two 70-ft., one 250-ft. and two 85-ft., together with the necessary approaches. Each span consists of three arch ribs, 11 ft., 16 ft. and 11 ft. wide respectively. The deck of the bridge consists of a 40-ft. roadway paved with sheet asphalt, two sidewalks 14 ft. 9½ in. in width and two balustrades 1 ft. 2½ in. in width. The piers of the bridge are on a 30-deg. skew and the large 250-ft. span of 40-ft. rise is one of the longest low-rise skew-arch spans in the United States if not in the world.

There are eight of the large, ornamental pylons or shafts placed on the bridge in line with the railings. Four of the larger shafts are placed over the piers of



250-FT. MAIN ARCH OF WILMINGTON BRIDGE

the large central arch and two of the smaller shafts at each end of the bridge. The large shafts extend 40 ft. above the sidewalk level and the smaller shafts 23½ ft. The bronze tablets are placed on the inside face of the shafts where they can be viewed by pedestrians on the sidewalk. On the inside faces of the smaller shafts are placed bronze nameplates 3x4 ft. On each side of the large shafts and on the approach sides of the small shafts are placed large, ornamental bronze lanterns which are illuminated by a single incandescent lamp of 250 candle-power. On the inside and outside of the large shafts are placed carved cast-stone eagles and shields of a monumental character. The balustrades were made of cast stone to harmonize with the surface treatment of the memorial shafts.

At the center of the span of the large arch a refuge bay was provided on both sides of the bridge by extending the sidewalk slightly beyond the line of the railing, thus forming a vantage point from which pedestrians may view the park below. Refuge bays were also provided at both ends of the bridge. Stone seats were placed in the refuge bays at the north end of the bridge to accommodate pedestrians who might desire to sit and rest. Large ornamental precast stone urns were placed on the end posts of the railing of the refuge bays at the north end of the bridge.

One stairway was provided for the bridge, at the south end on the east side, leading to the park sidewalk and illuminated by two bronze standards with lamps.

The lighting system of the bridge was arranged so as to harmonize architecturally with the pylons and railings, as well as to give the proper lighting effect to the sidewalks and roadway at night. The main lighting system consists of twenty-eight luminous arc lights supported by cast-iron light poles placed on the curb lines of the bridge. The secondary lighting system consists of the incandescent lamps in the twelve large bronze lanterns placed on the shafts and the two bronze standards at the stairway. The two lighting systems are on independent circuits.

The bridge was designed to carry the heaviest modern highway traffic and liberal provision was made for impact and possible future increases in traffic requirements. The assumed loads used in the design were 60-ton electric railway cars entrain on double tracks, a line of 20-ton motor trucks on the roadway at each side of the tracks and a sidewalk load of 100 lb. per square foot.

The two channel piers, each 20 ft. wide, the shore piers 8 and 9 ft. respectively and the two abutments support the 250-ft. center span with 40-ft. rise, two 70-ft. spans with 15-ft. rise and two 85-ft. spans with 18-ft. rise. Each arch has a center rib 16 ft. wide and two outer ribs 55 ft. apart on centers, that are each 11 ft. wide. The center rib of the 250-ft. span is 6 ft. deep at the crown and 11 ft. at the springing line, and the outer ribs 5 ft. and 10 ft. at crown and springing lines. Over each of these arch ribs and immediately under the floor slab there is a continuous gallery, one of which is reserved for high tension electrical conduits, the second for low tension electrical conduits and the third is used for gas and water mains. The reinforced-concrete floor slab, varying from 12 to 20 in. in thickness, exclusive of floorbeams which occur only at the expansion joints, is supported on longitudinal walls. These longitudinal bearing walls rest directly on the extradoses of the shore spans and are supported by the

ONE OF THE MEMORIAL PYLONS

spandrel columns of the channel span. The floor slab is arched transversely between ribs and is cambered 12 in. to a parabolic curve longitudinally.

The foundations of all piers and abutments were carried down to solid rock at a maximum depth of 5 ft. below water level.

The bridge was built under the direction of the Washington Street Bridge Commission, of which Frederick W. Carpenter was executive officer and consulting engineer. The design was made by Benjamin H. Davis, consulting engineer, New York, with the collaboration of Vance W. Torbert, architect, New York, as the result of a competition held by the commission. The contractor was the Walsh Construction Co., of Davenport, Iowa.

Progress and Plant Co-ordination, Concrete Road Work

Tentative Charts Laid Out at Beginning of Job for Progress Record—Later, Give Warning of Need for More Equipment

By Austin E. Page
District Construction Engineer, Pittsfield, Mass.

CHECKING progress on road construction by means of weekly charts on which the actual progress is plotted against the ideal schedule, was described by A. W. Dean, chief engineer, highway division, Massachusetts Department of Public Works, in *Engineering News-Record*, Jan. 11, 1923, p. 82. The planning and development of this ideal progress curve often present interesting problems. Thus, on one job last year, it was required to develop an ideal progress chart for the construction of 2.6 miles of concrete highway to be built in longitudinal half-width sections while keeping the road open to travel. The project was on a trunk line, with heavy traffic, and no construction work was to be done on the second half-width section until the first could be opened to travel, 10 days after laying the concrete surface.

The situation was carefully studied in the field with the contractor, who indicated the point at which he wished to start work and also supplied data based on previous performance, for working out the average daily output of each piece of machinery to be used. The contractor proposed equipment to include one excavating grader, one ¾-cu.yd. steam shovel, and one 2-bag paver.

Average daily output figures supplied by the contractor are always checked against the department's record of past performances of similar equipment on other jobs and where these disagree with the contractor's figures, the records are made available to him to help him in revising his estimates. The department's records also show that, because of rainy days, breakdowns and delays, it is unsafe to plan on more than five working days per week.

Figs. 1 and 2 show the ideal progress plan as finally developed. Fig. 2 shows the proposed progress on a cubic-yard basis for the three major items of work, and Fig. 1 shows proposed station to station progress for each piece of machinery and thus determines the equipment necessary to follow the schedule outlined in Fig. 2.

It may be stated at this point that the contractor and not the engineer outlines the plan of operations. Many times, however, the contractor's plan is vague and incomplete and when it is actually placed on paper, he recognizes that it will not work out to complete the job within the time allowed by the contract. Thus, Fig. 2 showed immediately that one mixer was not sufficient and that a second would be needed about the last of August. Recognition of such discrepancies in plan leads to further study and more careful planning and results in clearer understanding of the problems to be met.

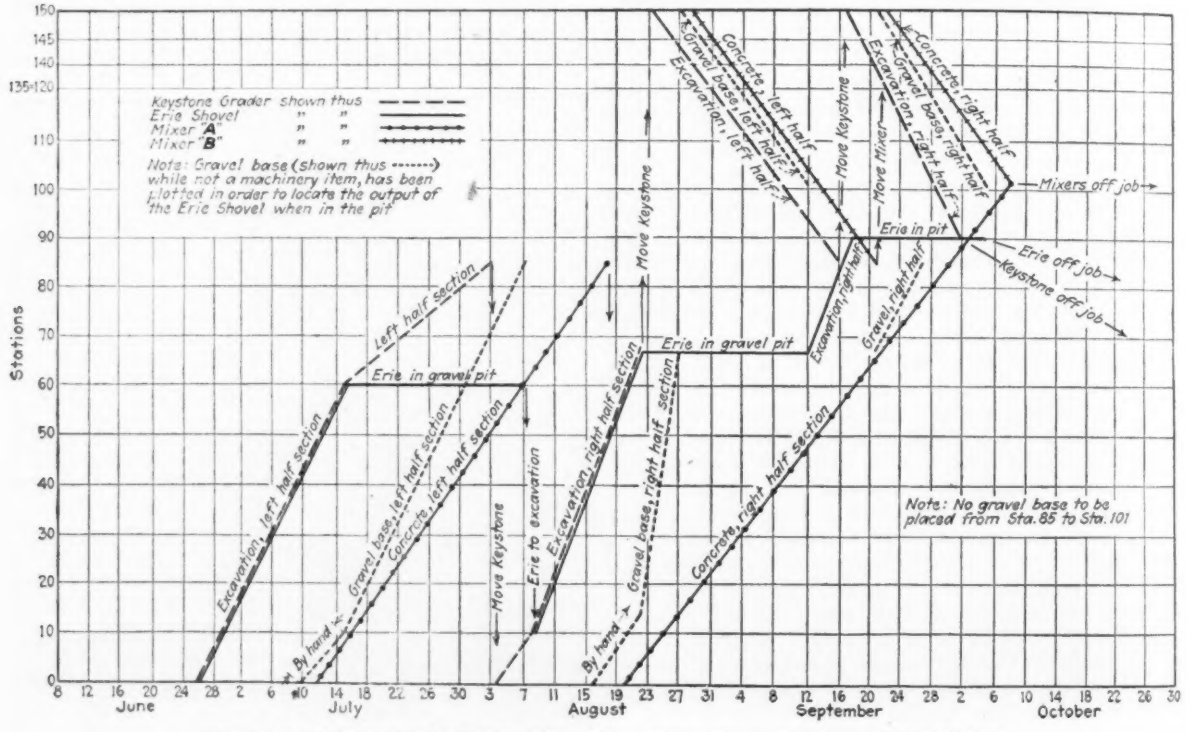

Keystone Grader shown thus
Erie Shovel " "
Mixer "A" " "
Mixer "B" " "
Note: Gravel base (shown thus ·····) while not a machinery item, has been plotted in order to locate the output of the Erie Shovel when in the pit
Stations
Left half section
Erie in gravel pit
Excavation, left half section
Gravel base, left half section
Concrete, left half section
Move Keystone
Erie to excavation
Excavation, right half section
Gravel base, right half section
Concrete, right half section
By hand
Move Mixer
Erie in pit
Mixers off job
Erie off job
Keystone off job
Note: No gravel base to be placed from Sta. 85 to Sta. 101
June
July
August
September
October

FIG. 1—MACHINERY PROGRESS SCHEDULE, TENTATIVE PLAN OF OPERATIONS

The method of developing the charts is as follows: It is decided to start excavation on the left half-section at Sta. O with both excavators, the grader to remove the old macadam, which is to be saved for shoulders, and the steam shovel to follow, excavating the earth. Then, from the "average daily output" figures, the direction of the first part of the "excavation" line on Fig. 2 is determined.

Concreting operations are to start on the left half-section at Sta. O on July 12. The gravel base must be

in place prior to this date and the natural method would be to place the steam shovel in the gravel pit on about July 10. The plan was developed along these lines until it became apparent that at some point on the job, the equipment would become "stalled." This condition occurs when excavating equipment approaches a section of road where one-half is covered with green concrete and the other half is open to travel and it is the nightmare of every contractor on a half-section concrete job.

The chart indicated that, to avoid this condition, more excavating work must be done before transferring a shovel to the gravel pit. Consequently, it was planned (see charts) to keep both shovels on the grade until July 15, and to place the first 200 cu.yd. of gravel base by hand shoveling. The remainder of the chart was worked out in much the same manner—selecting the most promising trial plan and working it through

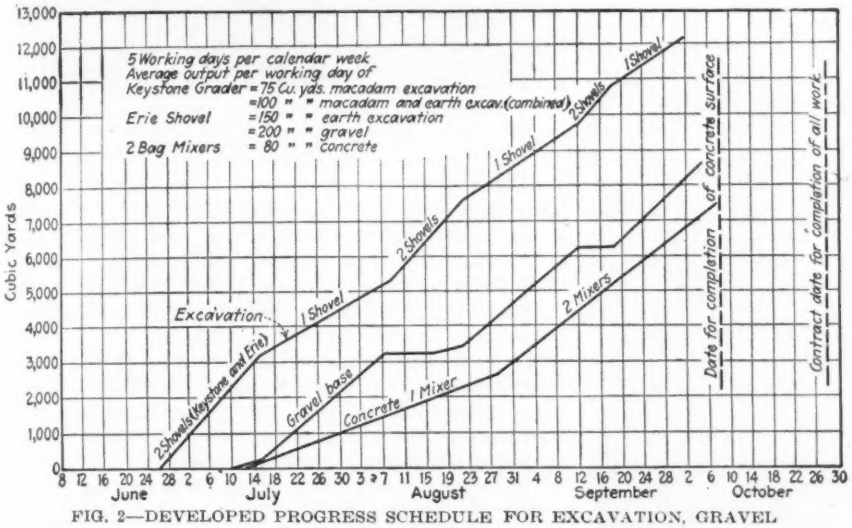


FIG. 2—DEVELOPED PROGRESS SCHEDULE FOR EXCAVATION, GRAVEL BASE AND CONCRETE SLAB

to conclusion or to a point where it was necessary to revise it.

A study of Fig. 1 will show that no construction operation takes place on the second half-section within ten days after placing concrete at any point on the first half-section.

The charts are developed together. Thus, on Fig. 2, the excavation progress line changes direction on July 15 when the grader (Fig. 1) is left alone to handle both macadam and earth excavation and again on Aug. 8 when the steam shovel rejoins the grader on the grade.

When construction work was started, the actual daily progress for the three items shown was plotted as a dotted line on Fig. 2. Thus, the progress on a cubic yard basis was immediately apparent.

Fig. 1 was used as a guide to plant layout and enabled the contractor to check the progress of each unit of machinery. It was revised on Aug. 15 because Mixer A could not keep up to schedule and again on Sept. 15 to plan for the addition of a third mixer, when Fig. 2 showed that the amount of concrete being placed by Mixers A and B was insufficient to complete the work within the time limit. It required several weeks to secure a mixer and without the warning given by the charts, it is improbable that it could have been secured in time to place all the concrete before the end of the season, as, in fact, was actually done.

Electrification on South African Railways

THE electrification project for relieving congested traffic conditions on the Johannesburg-Durban main line of the South African Government Railways, in Natal, has been modified materially as a result of the extensive line and grade improvement and double tracking west of Durban, as described in *Engineering News-Record* of Jan. 19, 1922, p. 116. The original plan was to electrify first the section from the port of Durban west 45 miles to Pietermaritzburg. But with the new second track and its more favorable grades on this section the traffic conditions were so improved that electrification was not needed for further improvement.

Serious congestion continued, however, on the single track line beyond Pietermaritzburg. New investigations were made by the consulting engineers, and on their recommendations parliamentary authority was obtained to proceed first with the electrification from Pietermaritzburg northwest to Glencoe, 171 miles, together with a 2½-mile branch from Merrivale to Howick. The track mileage to be electrified is 245 miles, with maximum gradient of 3.3 per cent uncompensated.

The contract for the supply of seventy-eight electric locomotives for this work has been placed with the Metropolitan-Vickers Electrical Co., Ltd., of England. The normal duty these locomotives will be called upon to perform is for three coupled together to haul a train weighing 1,430 short tons from Ladysmith to Pietermaritzburg—about 129 miles—in a little more than seven hours, and in the reverse direction a train weighing not less than 625 tons in about 7½ hours. The locomotives are to be capable of performing the round trip, under these conditions, once every twenty-four hours for six days a week. The gradients on the line between these points are mostly in favor of the fully loaded trains, the average between Ladysmith and Pietermaritzburg being 2.0 per cent.

Electro-pneumatic control will be employed, all the apparatus being mounted in a central compartment which will be locked in such a manner that the driver is unable to enter until the apparatus has been made "dead," thus avoiding all danger of contact with any "live" high-voltage parts. In view of the heavy grades to be met with on the line, the locomotives are arranged for regenerative control.

Most of the contracts for machinery and plant have been let, foundations for the power house at Colenso are being built and work on the building will be started soon. It is expected to have part of the line in operation by June, 1924, and the whole project completed early in 1925. The consulting engineers are Merz & McClellan, of London, England. This work is being carried out under the direction of Sir W. W. Hoy, General Manager of Railways and Harbors, Union of South Africa.

Building a 9-Ft. Siphon on the Hetch Hetchy Aqueduct

Armored With Concrete Outside and Lined With Cement Mortar Inside, Steel Pipe Crosses Reservoir Under 367-Ft. Head

By N. A. Eckart
Chief Assistant Engineer, Hetch Hetchy Project

THE CITY of San Francisco has just completed, as part of the Hetch Hetchy water supply project, an inverted siphon 9 ft. 1½ in. in diameter across the Tuolumne River at Red Mountain Bar. The siphon constitutes a short section of the main aqueduct that will later be built to convey water from Moccasin Creek power house to San Francisco. It is located 5 miles below the power house and will be the connecting link between two sections of a 17-mile tunnel to be driven from Moccasin Creek power house to a point near Oakdale, whence the aqueduct will continue in the form of a steel pipe line across the San Joaquin Valley and toward San Francisco. At the present stage of the Hetch Hetchy project a total of 112 miles of tunnel and

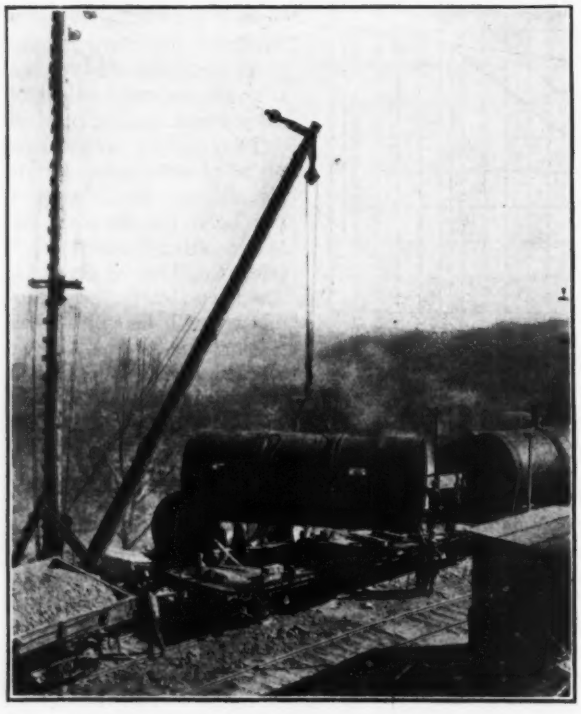


FIG. 1—DELIVERING 9½-FT. PIPE SECTIONS TO THE TRAM
These sections, weighing 12 to 16 tons, were skidded to place in the trench from the tramway running alongside.

aqueduct must still be built before water from Moccasin Creek power house can be delivered to the distributing reservoirs of the present San Francisco water system.

The Red Mountain Bar siphon was constructed in advance of the remainder of the aqueduct because the Don Pedro Dam, just being completed by the Modesto and Turlock Irrigation District, will back the water of the Tuolumne River above Red Mountain Bar, submerging the siphon crossing to a depth of 73 ft., thus rendering uncertain its future accessibility.

The siphon as installed consists of 776 ft. of riveted

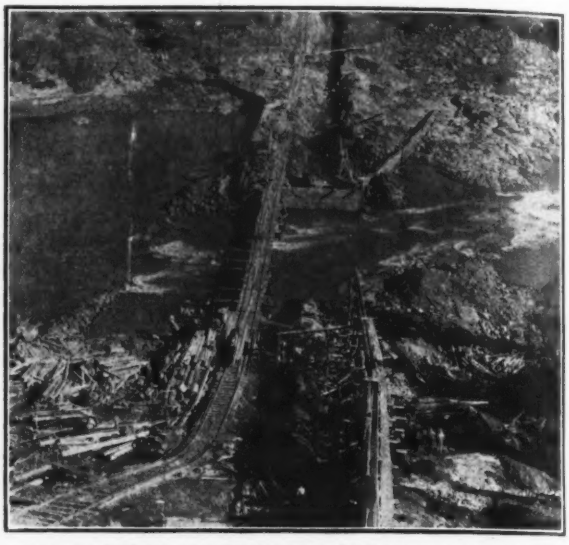


FIG. 2—CONSTRUCTION WORK IN SECOND COFFERDAM
The two halves of the river channel were cofferdammed successively; this view shows stream diverted over finished portion of siphon, while work is begun on the far side just unwatered.

butt strap pipe, 9½ ft. in inside diameter, with a plate thickness varying from $\frac{5}{16}$ in. to $\frac{3}{4}$ in. by sixteenths. The pipe is encased in a concrete jacket of 1:2½:5 mix from 18 to 24 in. in thickness and is lined inside with mortar 2¼ in. in thickness which was put in to increase the permanency of the construction.

The pipe was delivered, on a siding of the Hetch Hetchy R.R. immediately above the crossing, in sections, normally 24 ft. long, each section being made up of three 8-ft. courses and weighing from 12 to 16 tons, according to the thickness of the plate.

The pipe was laid in a trench excavated in bedrock across the river channel. The lowest point in the siphon is 367 ft. below the hydraulic gradient and hence will normally operate under that head. The stream flow at the crossing during the period of construction ranged from 400 sec.-ft. to 1,100 sec.-ft.

The first step in the field work was the installation of a standard-gage tramway and trestle across the river just above the line of the pipe, the upper end of the tram being at a siding on the Hetch Hetchy R.R. A derrick was installed at this point for handling the pipe directly from the cars to the tram; this also served for handling concrete materials to the tram from the storage bins constructed adjacent to the spur.

At low water cofferdam frames had been built entirely across the stream bed above and below the pipe line and were well braced and anchored to the bedrock. A transverse partition in the center divided the cofferdam into two halves and by the use of sheathing on first one half and then the other the two halves of the channel were successfully unwatered, the trench was excavated, and the pipe laid in the dry. The cofferdams were quite tight, all leakage being handled by one 6-in. and one 10-in. centrifugal pump. While the trench was being excavated an unusually heavy rainstorm, coming earlier than the normal seasonal rains, caused the stream to rise from about 1,000 sec.-ft. to 11,000 sec.-ft. and washed out a short section of the cofferdam. This was quickly replaced with cribs floated into place, where they were loaded with rock, sunk and faced with sheet piling.

The trench excavation across the channel was handled

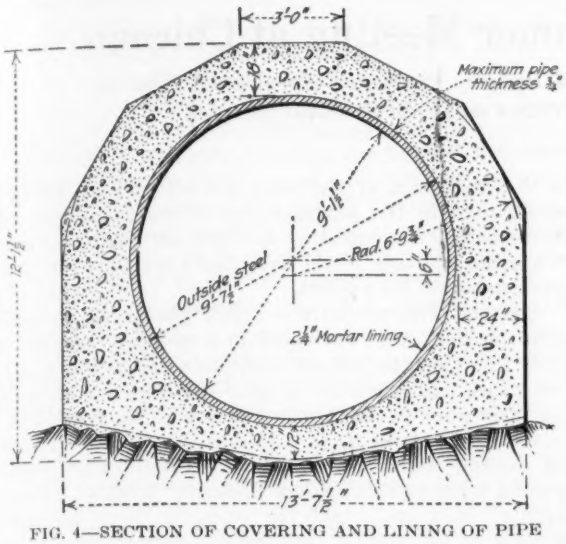


FIG. 4—SECTION OF COVERING AND LINING OF PIPE

by skips and derricks; the pipe was lowered to place from the tram with the aid of skids down which it was rolled in a bight of cable. Each section of the pipe as it was placed in the trench was riveted and lined up on wooden blocks which were immediately thereafter replaced by concrete piers poured in forms constructed of sacks of sand. These sack forms worked out particularly well in this case where the piers were later to be incorporated into the concrete jackets; the rough surface left by the sand bags giving an excellent bond for the concrete.

When enough pipe had been riveted up to reach from mid-stream to a point above high water, bumped test-heads were riveted to each end of the section and a test pressure of 200 lb. per sq.in. was applied and all joints made tight. A small high pressure single plunger pump with a capacity of 40 gal. per minute, driven by a gasoline engine, was used for testing and for maintaining the pressure in the pipe while the concrete jacket was being poured and allowed to set.

After pipe laying in the first cofferdam had been completed, a concrete partition wall was constructed between the up and downstream faces of the cofferdam, permitting the pipe to extend through the wall. The river was then diverted over the completed section of the pipe and excavation and laying of the pipe were continued on the other side of the river.

The concrete mixer for the work was located above the highest point of the pipe line below the railroad and all concrete for the jackets on that side of the river was placed directly by chutes. The concrete on the opposite side of the river was delivered in concrete dump cars over the tram line, the cars being loaded from a hopper fed by chutes from the mixer.

The pouring of the concrete was generally continuous, except where the work was stopped for testing purposes. Where a construction joint was necessitated the form was bulkheaded with sacks of sand against which the concrete was poured, leaving a rough surface suitable for bonding when the sacks were removed.

The last operation was the placing of the mortar lining inside the pipe. The form for this lining was sheathed with wooden staves as manufactured for wood-stave pipe. These forms were made up in segments held in place by a collapsible frame. The forms were centered inside the pipe by means of small precast concrete blocks about 4 in. square formed with tapering sides so as to key into the lining. Light reinforcing was cast in these blocks with projecting ends to bond into the cement mortar. The mortar used in the lining consisted of one part of cement to 1½ parts of sand and was poured through 2½-in. saddles riveted to the pipe for that purpose at 16-ft. intervals. This mortar was mixed in the concrete mixer and delivered in cars over the tramway.

At the lowest point of the siphon a 12-in. blowoff was installed connecting with a line of 12-in. pipe which was carried up above the level of the reservoir surface. Two valves are installed in this line, one at the upper end and one at the lower level, permitting operation at different reservoir heights. For part of its length this blowoff pipe line is embedded in the concrete jacket of the main siphon and for part of its length is supported on concrete piers.

FIG. 3—SIPHON NEARING COMPLETION, COFFERDAM REMOVED
Track still to be used for delivering cement mortar lining. Concrete wall in center of channel is a permanent feature.

The work was carried on by city forces on a day labor basis. W. A. Kraner, acting as superintendent, was responsible for plant layout and field installations. The engineering details and design were by L. W. Stocker, assistant engineer, all under the general charge of M. M. O'Shaughnessy, city engineer.

Decline of Typhoid Fever in Maryland

The typhoid death rate in Maryland declined from 42.8 per 100,000 in 1910 to 7.3 in 1922, according to an advance copy of the 1922 report of Abel Wolman, chief engineer, Maryland State Board of Health. Omitting Baltimore, the rate fell from 43.5 to 10.7. The 1920 rates for the whole state and for the state outside Baltimore were 6.9 and 9.1 respectively.

Civil Engineers Have Summer Meeting at Chicago

Technical Sessions Devoted to Discussion of Railway Problems—President's Address Emphasizes Society Co-operation—Protest on Davis Removal Adopted

Engineering News-Record Staff Report

PLENTY of excursions in delightful weather, a large attendance (over 700), a modicum of business and a surfeit of technical papers which effectually prevented discussion characterized the 53rd annual convention of the American Society of Civil Engineers, held at Chicago on July 11-13. That engineers should "go into politics" in the sense of getting acquainted with men and affairs outside of strictly technical lines was suggested by Mayor Dever in his address of welcome. He referred also to the great importance of the engineer and his work in relation to transportation and municipal development. Incidentally he expressed his willingness to accept advice or suggestions from technically competent men and organizations.

President Loweth on Co-operation—Active co-operation between the various engineering societies was advocated as desirable and necessary by C. F. Loweth in his presidential address. It has been said that if this society had lived up to its early opportunities it might now be the one all-embracing engineering society, but Mr. Loweth questioned both the possibility and desirability of such a result. There is already a large degree of co-operation in regard to technical matters, as illustrated by the Engineering Standards Committee and the National Research Council, but there is need for more concerted activity in matters relating to the public service of the profession and to its general welfare. Certain requirements for such co-operation were noted and it was pointed out that the dangers of a superorganization must and can be avoided. That the decisive vote against joining the Federation (which Mr. Loweth did not mention by name) was based on the plan and not the spirit of co-operation is shown by the history of the Society. A review of the development of engineering societies and the American Society of Civil Engineers was included in Mr. Loweth's address. Increase in membership of the Society slackened after the war but is now again reaching the normal rate of growth. Attendance at the annual conventions, however, is not in accord with membership increase and this matter is having the consideration of the officers. Under the new plan of divisions for separate subjects there are now five divisions and Mr. Loweth expects that others will be organized.

Many Papers But No Discussion—Engineers at this convention were subjected to endurance tests in the two morning sessions. At the first session, six papers were presented after the opening ceremonies and at the second session no less than ten papers were crowded into a 3-hour stretch. In order to keep within even these long limits the papers had to be read hurriedly, some in full and others in abstract. There was no opportunity for discussion and it is creditable to the members that so many sat out to the end. With one exception the papers were read by their authors. All the papers were good, but in the aggregate they were too long and too solid. Two or three at each session would have received better attention. Further, if the six papers on Chicago terminals had been compiled into one fairly long paper, with a minimum of statistics but with all the lantern slides used in the separate papers, the subject would have been more interesting and have occupied less time, while the audience would have had a much better comprehension of the subject.

Railroad Transportation—Public phases of the railroad problem were presented in a group of papers on July 11. That the railroads should be freed from political attack and agitation in order that they might carry on their work in the interests of the public and the investors, was urged by C. A. Morse (C., R. I. & P. Ry.) in dealing with "Consolidation of Railroads." In a second paper on this subject Professor Worley (University of Michigan) said the proposal for a score of groups is too drastic; he thought that at first there should be nearly a hundred groups. In reviewing "Federal Valuation of Railroads," E. F. Wendt (Washington, D. C.) pointed out that the value of the property is fundamental to public regulation in such matters as rate making, capitalization, consolidation, joint use of terminals and construction of new lines. He believes that the aggregate value of the railroads as determined by the Interstate Commerce Commission will substantially equal their capitalization.

Transportation as related to national progress was reviewed interestingly by J. G. Sullivan (Winnipeg). Railroad construction has been a great factor in this progress, but if carried to extremes it may be actually detrimental to the public interest. This condition is illustrated in Canada, where railway development has aided settlement and prosperity in a high degree, but where inflated construction under government guarantee for political purposes has now burdened the country with an annual deficit of $60,000,000 to $80,000,000. That investments in railroad securities include those of a great army of small investors (representative of "the public") and are not merely those of "big capital" was pointed out by John W. Kendrick (Chicago). Railroads as arteries of commerce were discussed in a paper by J. R. Bibbins (Washington, D. C.) which was read in his absence.

Railroad Terminals—That terminal facilities were needed badly was the theme of a group of ten papers crowded into the morning session of July 12. After an opening paper by H. R. Safford (C., B. & Q. R.R.) the subject of "Principles of Terminal Station Design" was discussed by Alfred Fellheimer (New York) in relation not only to broad features such as public relations, utilizing air rights and merging of terminals due to consolidation, but also as to traffic considerations and station facilities. Improvement and ultimate unit operation of the complicated freight terminal facilities of St. Louis was advocated by Charles E. Smith (St. Louis) on the basis of the comprehensive report abstracted in *Engineering News-Record* of July 6, 1922, p. 17. In "Street Development in Relation to Railroad Terminals," J. L. Crane, Jr. (Chicago) pointed out that the intensive use of limited city areas has produced more traffic than the streets can properly accommodate.

This difficulty may be overcome in many cases by railway and municipal authorities co-operating in the joint planning of terminals and street systems.

Six papers on the Chicago railroad terminals dealt with specific works and prospects but involved considerable repetition in explaining local conditions. That the new Union Station will be a one-level station in spite of its size was one of the points brought out by J. D'Esposito, chief engineer. Some of the new tracks are already laid and the headhouse is under construction. In regard to the new Illinois Central R.R. terminal works, representing the most extensive of the Chicago projects, D. J. Brumley, chief engineer of terminal improvements, estimated that the electrification will result in speeds as high as 57 m.p.h. on the suburban express runs and that such service will be in operation in three years.

An unusually broad-minded attitude is shown by the city of Chicago in requesting the railroads to co-operate in a study of the improvement of the street layout and complicated terminals adjacent to the south side of the loop district, including three passenger stations. This problem was presented in two papers by R. H. Ford (C., R. I. & P. Ry.) and F. E. Morrow (C., & W. I. R.R.). Projects for rail and water terminals in the Chicago district were described by Major Rufus W. Putnam, U. S. Engineers. Finally the original and adopted designs of the great freight station and warehouse built at Chicago a few years ago by the Pennsylvania R.R. were described by W. L. R. Haines (Pittsburgh).

Business Affairs—Only a few minutes were devoted to a business meeting after the protracted morning session of July 11, the most important action being the adoption of a resolution and statement prepared by the Board of Direction in protest against the summary dismissal of A. P. Davis as Director of the U. S. Reclamation Service. Another resolution expressed the Society's feelings at the murder of John E. Shoemaker in the massacre at Herrin, Ill., while in the discharge of his duties. This resolution also deplored the fact that though this outrage occurred a year ago, the State has been unable to bring the guilty parties to justice. At the closing session a resolution was adopted regarding the death on July 11 of Captain Robert W. Hunt, the noted engineer and metallurgist. In addition to the actions of the Board of Direction noted last week, the board adopted a resolution of protest at the attitude of the municipal authorities of Pittsburgh in intrusting the design of large bridges to architects.

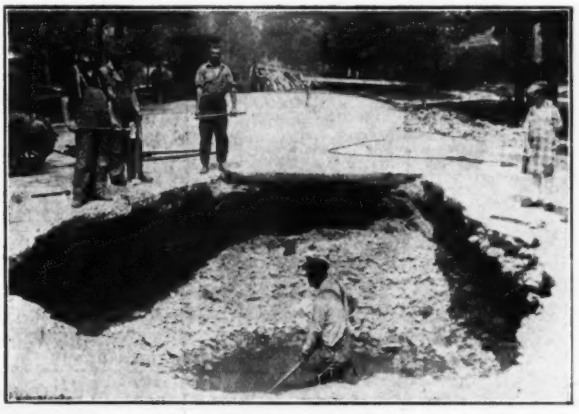
Brief and lightly attended meetings of the highway, sanitary and city-planning divisions were held in the afternoon of July 11, when the power division also held a meeting for the presentation of papers on power development, by W. L. Abbott (Chicago) and on ice problems of hydro-electric plants, by W. T. Walker (Minneapolis).

The sanitary division accepted the invitation of the Sanitary Association of New Jersey to co-operate in working out sewage disposal problems in that state and authorized the appointment of a committee to work for a bill giving engineers in the U. S. Public Health Service equal status with that of the medical officers. The matter came up through a letter from Sol Pincus outlining a course of action and also by reference to the division by the Board of Direction. S. A. Greeley reported ready response from sanitary engineers in contributing for the proposed annual medal for the best contribution on the fundamentals of sanitary engineering. Opinion seemed to favor calling this the Rudolph Hering medal. The highway division discussed proposed activities of the division and the program of the Richmond convention, opinion on the latter being that "bond issue" topics had better be omitted.

Excursions included trips to various local industries and points of interest, and there were two informal dinners followed by dancing. For July 13 two all-day trips were arranged: one on a steamer cruising along the lake front to show the numerous park improvements and industrial developments, the other by rail to Milwaukee to inspect the sewage treatment plant.

Pavement Undermined by Large Sewer Withstands Traffic

ALTHOUGH unsupported for an area 17 ft. wide and 25 ft. long, a 6-in. concrete pavement slab in North Sixth St., Sheboygan, Wis., for an indefinite time withstood heavy traffic which included a 7-ton power flusher carrying 5 tons of water. The pavement was undermined by the sandy material finding its way into an



BREAKING DOWN UNDERMINED UNDAMAGED CONCRETE PAVEMENT TO MAKE SEWER REPAIRS

Cavity 25 ft. long and 17 ft. wide formed by material washing into sewer was not disclosed until sewer became clogged. A 7-ton power flusher used this street for some time before the cavity was discovered.

18-in. sewer 13 ft. below grade. The cavity was about 8 ft. deep when discovered through a clogged sewer.

The paving laid in 1921 was 6 in. thick at the center rather than the usual 8½ in. required by specifications because it was laid over 20-year old macadam which was considered to have a good bearing power. However, C. U. Borley, city engineer, states that the macadam at the center of the street was nearly all removed in grading to subgrade and some doubt was expressed at the time of the sufficiency of using only a 6-in. slab on a 40-ft. street with a 5-in. crown making a decidedly flat arch. As shown in the photograph, a transverse expansion joint cut entirely through the pavement 3 ft. from one end of the cavity.

For the base the mix was 1:3:5 and for the 1¾-in. top it was 1:2:4. The mesh reinforcing was placed near the top of the slab to meet temperature stresses so it had little value when the slab acted as a beam.

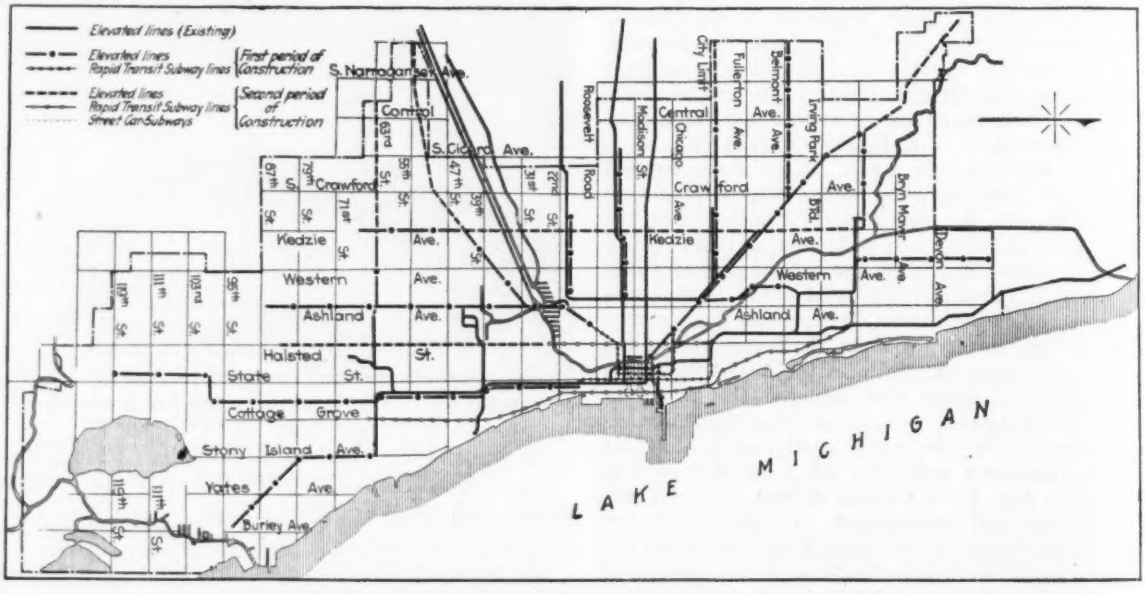
In removing the slab to make repairs to the sewer an opening was cut 20 ft. long with sledges and bull points. This narrow opening was then widened with sledges breaking the concrete into small pieces without developing any large cracks or getting out any large pieces.

Chicago City Council Plans Unified Transit System

To Rearrange and Extend Existing Lines—Universal Free Transfers—Few Subways—Interchange with Electrified Suburban Lines

Abstract of the report and recommendations on a physical plan for a unified transportation system for the city of Chicago, made by R. F. Kelker, Jr., chief engineer of the committee on Local Transportation of the City Council of Chicago.

THE PLAN of the local transportation committee of the Chicago City Council to improve the transit situation of the metropolitan district is at variance with most former proposals in that it proposes modification and extension of the existing elevated and surface lines, with the addition of a comparatively small mileage of new subways, rather than a large mileage of new subways and the abandonment of a great deal of the existing systems. It calls for the introduction of universal free transfers between the present surface and elevated lines as a means of giving immediate relief from the surface congestion in the Loop District and of speeding up the passenger movements. The plan also proposes as a future development an interchange between the electrified suburban lines of the trunk railroads and the city rapid transit whereby rapid transit trains can be routed to suburban points and suburban trains can have access to the entire rapid transit system.



GENERAL PLAN OF THE PRESENT AND PROPOSED RAPID TRANSIT LINES

The metropolitan district of Chicago as assumed for the purposes of this report has an area of 275 sq.mi., and a population of approximately 3,000,000. It is estimated that the population will be 5,000,000 in 1950. The district is peculiar in that it is semi-circular in form with the central business district, the normal center of the area, located at the extreme easterly edge and close to Lake Michigan. Obviously then the length of haul is considerably greater than if the area was circular in form. At present the central business district is restricted to the area bounded on the east by the railroads along the shore of Lake Michigan, on the north and west by the industrial district along the Chicago River, and on the south by the railway terminal area. Its growth is practically confined to this area by the fact that with one exception the only rapid transit lines in the city terminate there. The one exception is the stockyards branch.

The present city transportation system is made up of surface lines, elevated lines, and bus lines. The layout of the first two was based on the demand of earlier years, and with the exception of the rehabilitation and extensions made between 1907 and 1911 no changes have been made to meet the demands of the expanding city.

The Chicago Elevated Railways, a voluntary consolidation of the four former elevated companies, comprise the rapid transit system of the city. The combined lines have 162 miles of track but carry only 17 per cent of the revenue passenger traffic. The growth of traffic has not kept pace with the increase in population due to the limited terminal facilities of the central business district and the financial inability of the companies to extend their lines. The reason for not obtaining the maximum capacity is apparent when it is realized that thirteen tracks converge on the Union loop, a double track loop operating in the central business district.

The Chicago Surface Lines, a similar consolidation of four surface railways, comprise 1,060 miles of single track, and carry 71 per cent of the traffic. These railways present a nearly uniform development of trunk and cross-town lines which are intersected by lines on the important radial streets. The limited capacity of the elevated has forced an unusually large proportion of the people to use the surface lines but even so 30 per cent of the lines do not pay the cost of operation. Single fare transfers are used on both elevated and surface lines but the two systems are in competition and do not exchange transfers. Two fares are therefore necessary in order to get the full benefit of the two systems. This condition results in the remarkable length of the average ride on surface lines of 4.2 miles. Bus lines now operate over 23 route-miles and carry 1 per cent of the passengers. The remaining 11 per cent are carried by the suburban lines.

The result of all these conditions is that the maximum number of cars that can now be operated on both the surface and elevated routes which terminate in or pass through the central business district is determined by throats or controlling points in that district. As the present outlets from this congested district are used nearly to their practical limit the capacity of these routes throughout their length is thus fixed by these controlling points. The elimination of such controlling points will

be accomplished by the development of the plan recommended in this report.

Elements of the Plan—The fundamental elements of the plan are as follows:

(a) Long haul traffic carried on rapid transit lines,
(b) Short haul traffic carried on surface lines serving as feeders to the rapid transit lines,
(c) Transfers between surface and rapid transit lines to facilitate (a) and (b),
(d) Unification of independent systems to eliminate competition and the resulting needless duplication,
(e) Transportation system planned in advance of traffic demands,
(f) Use of existing structures as far as possible to form part of the complete system,
(g) Connection of various outlying commercial centers in such a manner as to provide rapid transit without passing through congested centers.

The fundamental principle of the whole plan is the use of existing facilities as far as possible. The committee justifies this idea by the fact that a former proposal to construct an independent system of subways would cost $550,000,000 more than the proposed system. It also points out that approximately four miles of elevated railway can be constructed at the cost of one mile of subway.

The proposal to build street car subways in the central business district is postponed to the second period of construction as they are expensive and not economical to operate and may be found unnecessary by that time. The proposal to scrap the Union Loop and replace it by subways is also considered unjustified for some years to come.

The key to the solution of the terminal problem is found in providing four tracks through the central business district for North and South Side trains by devoting two tracks of the Union Loop in Van Buren St., Wabash Ave. and Lake St. to the exclusive use of West Side trains. This will be accomplished by the construction of a two-track subway in State St. and in North Ave. from a connection with the South Side Elevated to a connection with the Northwest Elevated, and by the construction of a two-track elevated railway on Wells and Polk St. to a connection with the South Side elevated.

Bus lines are recommended only for use as feeders in outlying districts until the density of traffic along their routes will justify the construction of surface lines.

When the *excess* capacity of the city's urban lines is sufficient to accommodate all or part of the suburban traffic the committee recommends that a study be made to coordinate the unified city system with the electrified suburban railroads. It outlines a plan whereby a connection would be made with such railroads about five miles out from the center of the city, where rapid transit trains and suburban electric trains could interchange, thus making the whole rapid transit system available to the suburban service and reducing the concentration at the railroad terminals. This will make it unnecessary for the railroads to acquire more costly property for additions to their city terminals.

The Comprehensive Plan—The committee recommends that the construction program be divided into two periods as follows: A First Period of Construction, which includes such parts of the plan as are urgently required and can be definitely located at this time; and a Second Period of Construction, which includes the remaining parts of the plan, adjusted to suit the changes that will occur before that time. At the end of the two periods the city will have a complete Unified Transportation System to accommodate the needs of Chicago when its population shall have reached 5,000,000 which is estimated to be about the year 1950. This system is shown for the whole city in Fig. 1. It includes the following divisions:

(a) Rapid transit subways:
  (1) The State Street subway
  (2) The Clark Street subway
  (3) Cottage Grove—Broadway subway
  (4) Halsted Street subway
(b) Elevated Railroads:
  (1) Mid-City trunk line
  (2) Northwest Side lines
  (3) Southwest Side lines
  (4) North Side and South Side lines
  (5) West Side lines
(c) Additional street railways
(d) Street car subways in Washington and Jackson Streets in the central business district.

TABLE I—ESTIMATED COST OF UNIFIED SYSTEM

	First Period	Second Period
Rapid transit subway	$44,330,000	$75,810,000
Elevated railways	71,173,000	30,115,000
Surface railways	13,770,000	8,595,000
Cars	72,750,000	27,600,000
Substations, shops, yards	15,820,000	6,000,000
Street car subways	None	6,870,000
	$217,843,000	$154,990,000
		217,843,000
		$372,833,000

The estimated cost, including cars, yards, substations, and terminals is shown in the accompanying table.

Results Accomplished—Unification of all the existing lines, and the use of single-fare transfers will give some immediate relief and will be of added advantage as the system is expanded. Lack of unification has resulted in 85 per cent of the people riding on the surface lines, the more expensive means of transport, while the elevated lines were not used to advantage.

TABLE II—MILES OF SINGLE TRACK

	Existing Systems	First Period of Construction	Second Period of Construction	Construction Periods Total	Unified System Total
Rapid transit subways	None	17.6	37.3	54.9	54.9
Elevated railroads	162.0	137.0	67.2	204.2	366.2
Total rapid transit	162.0	154.6	104.5	259.1	421.1
Street car subways	None	None	2.5	2.5	2.5
Street railways	1,060.0	153.0	95.5	248.5	1,308.5
Total mileage	1222.0	307.6	202.5	510.1	1732.1

Transfers and the relocation of surface and elevated stations will make it possible for more people to use the elevated lines for the long part of their ride and will consequently make it possible for 70 per cent of the present number of surface cars now operating in the central district to handle the traffic which will still have to use them.

Other benefits of the unified system will be:

(a) Faster running time, a reduction of the long-haul riders' time from an average of forty-five to twenty-five minutes;
(b) Increased capacity—by eliminating the throats or controlling points of the central business district which are now taxed to capacity, and by adding lines which will make the joint capacity at the end of the first period of construction double the present capacity;
(c) Development of business centers;
(d) Development of residential districts;
(e) Relief of the congestion in the central business district, by the reduction of the number of surface cars, and by making it possible for the district to expand across the Chicago river to the north;
(f) Reduction of operating expenses, as the operating cost per mile on rapid transit lines is only 75 per cent of the cost of surface lines and the unification of the system will shift the bulk of the passenger mileage to the rapid transit lines.

Engineer-Legislators in Canada

Engineers in the federal and provincial legislatures of Canada total 12 out of a total membership of 915, or about 1.3 per cent, according to a count made by *The Canadian Engineer*. In the federal parliament there are two engineers in the senate and three in the house. Of the nine provinces Quebec and British Columbia each has two engineer-legislators; New Brunswick, Ontario and Alberta one each; and the other four provinces none.

Operating Costs on Grinder Used To Make Sand From Basalt

Absence of Sand at Copco Dam Necessitated Grinding Up Rock for Concrete Aggregate —Sand Cost Was $1.10 per Cu.Yd.

By P. O. Crawford
Chief Engineer, California Oregon Power Co.

IN THE construction of the Copco Dam on the Klamath River in northern California some years ago, the California Oregon Power Co. was unable to locate a deposit of sand near the dam suitable for concrete and finally installed two Williams Universal No. 3 sand grinders. For the first three months black volcanic cinder was put through these without good results. The cinders were moist and clogged the grates, cutting the sand production very low and wearing the bars and hammers excessively. Drying the cinders did not materially improve conditions. However, the same grinders were later used to make sand from a hard basaltic rock, found at the site, which has a specific gravity of about 2.7. This sand was very satisfactory and, owing to the larger percentage of fines, produced a denser concrete than would have been secured with river sand. In view of this success, when it was decided in 1922 to add to the power house and increase the height of the dam, one of the sand grinders was again used with the results cited in the following.

This time the grinder was mounted just below the delivery of the belt conveyor from the gyratory crusher and the supply chute was so arranged that any portion from zero to 100 per cent of the crusher product could be diverted to the grinder. Ordinarily the chute was set so that 40 to 45 per cent of this crusher-run rock, varying in size from dust to 5-in. rock with some larger pieces, went into the grinder. The average size of this material was between 1½- and 2-in. rock.

MECHANICAL ANALYSES OF SAND FROM GRINDER
(Percentage by Weight, Passing Through Each Screen)

Screen Mesh Per Inch	Average of 1917 Tests Per Cent	Average 5 Runs Apr. 8, 1922 Per Cent	Average 4 Runs Apr. 12, 1922 Per Cent	May 10, 1922 Per Cent	May 8, 1922 Per Cent	Average 8 Runs Nov. 22, 1922 Per Cent
4	81.5	....	57.0	89.5	76.2	91.0
10	60.4	70.8	21.1	63.5	66.2	72.5
20	44.5	47.6	12.2	48.5	56.2	50.7
30	36.6	38.6	10.8	39.6	51.7	45.8
50	28.8	31.5	10.2	27.0	48.0	35.4
100	20.8	13.5	3.2	0.5	19.3	23.6

The resulting sand was quite variable due to the wearing of grate bars, hammers and liners and was subject to sudden changes due to the wearing out or breaking of bars, in which cases rocks up to 1 in. in diameter would come through. Trouble was also caused whenever pieces of drills, etc., inadvertently got into the feed. The variation in mechanical analyses is shown in the accompanying table.

Although recognizing the advisability of feeding only small rock through the grinder so as to keep the wear down to a minimum, in this case it was found best to pass part of the fines from the crusher to a ¼-in. mesh revolving screen and to use the portion passing through the screen as sand. These screenings constituted about 25 per cent of the sand used on the job; the remaining 75 per cent was furnished by the grinder.

It should be noted that if the product of a grinder operated in this manner is to be stored in a large sand bunker some means of keeping a constant check on the grinder product before it reaches the bunker should be provided, otherwise in case of worn or broken bars a considerable volume of coarse material might be delivered to the bunker before the variation in the product was discovered.

Provision must also be made for keeping the grinder product dry, otherwise it becomes hard to handle because of the percentage of dust contained. The irregularity of the product and the occasional large pieces made it preferable not to use this sand for finishing work such as floors, etc., although doubtless this would not have been the case with soft rock.

The separation of grate bars as supplied for renewals was ⅛ in. and it was found desirable on this work to increase this opening to ¼ or ⅜ in. by welding lugs to the ends of each bar to serve as spacers. With new liners and hammers the clearance between the ends of hammers and the first grinding plates is about ½ in. This clearance and the space between bars was found to increase rapidly so that a new set of grate bars in the bottom half of the grinder was required every two to two and a half weeks. Any bars not entirely worn out when these renewals were made were placed in the upper half where there was less wear.

The hammer bars in this machine are arranged so that as the outer end wears they may be moved out from the center ½ in. at a time for a total gain of 3 in. In grinding this material it was necessary to move them out one hole about every week and after each two moves it was found best to take the hammers out and have the tips squared off as they wore to a point which resulted in a cutting rather than a crushing blow. When the hammer bars had worn too short for further service two such stubs were welded together to make a single new bar.

In a period of seven months one of these grinders turned out approximately 3,600 cu.yd. of sand operating about 180 nine-hour days at a cost of $3,031 for new parts and $700 for labor on operation of repairs and installation of new parts. This total gives a unit cost of 84 cents per yard for new parts and 19½ cents per yard for labor on repairs and renewals. The total cost of sand secured in this way was put, in round figures, at $1.10 per cu.yd. This figure does not include any quarry cost nor power for the 50-hp. motor used to drive the grinder. It is safe to say, however, that any imported sand of equal quality would have cost at least twice as much as this even with quarry and power costs added.

During this seven-month period there were placed in the grinder 5½ sets of hammers and six sets of grate bars. Approximately 110 man-days were required for these changes and renewals and also for repairs including blacksmith work in welding and dressing hammers.

Low Typhoid Death Rate for England in 1922

The typhoid death rate for England and Wales was 1 per 100,000 in 1922, according to a return issued by the registrar general. With the single exception noted below, and omitting decimals, there was no variation either by seasons or for the total as compared with the urban population. The variation mentioned occurred in the second quarter of 1922, when the rate in the "smaller towns" (20,000 to 50,000 population) was 2 instead of 1 per 100,000. The total mid-year population was estimated as 38,150,000 of which 19,170,420 was in 105 "county boroughs and great towns" and 4,931,620 in 155 "smaller towns."

Air Vibrations Due to Fluttering of Water Sheet Over Dams

Partial Vacuum Between Water Sheet and Face of Dam Produces Waves That Rattle Objects in Nearby Buildings

By Frederic I. Winslow
Division Engineer, Metropolitan Water-Works, Framingham, Mass.

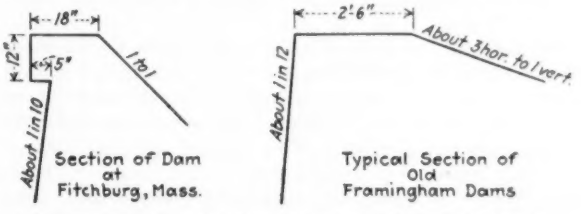
WHAT APPEARS to be a strongly marked case of the comparatively rare phenomenon of vibrations transmitted through the air to a considerable distance occurs about once a year on the Sudbury section of the Metropolitan Water-Works, at Framingham, Mass. The occurrence is noted on two dams, each having a face with a batter of but one in twelve (see sketch). A third dam of similar section but having the sheet of water broken by a continuous rod passing just above the crest of the dam is free from such vibrations. As a result of these vibrations windows rattle, dishes sometimes fall from shelves, and insecure piles of boxes topple over, when the effect is most pronounced, over a mile from the dam. At times the sound effect is similar to that produced by an explosion except that it is more like a series of mild explosions. A like phenomenon has given trouble near Fitchburg and slight vibrations are reported from a few other dams.

As the dams are built on compact sand and no rock is in evidence, the only explanation of the phenomenon is a partial vacuum between the sheet of water and the face of the dam which causes a fluttering which appears to operate on a large scale much as does the diaphragm of a telephone receiver. The sheet of water flowing over the dam and vibrating uniformly, imparts to the atmosphere a series of waves which resemble wave translation in water, or sound waves in the air. Another analogy is the electromagnetic waves produced in wireless telegraphy by a spark discharge which resembles those produced in the atmosphere by an explosion, or the continuous wave produced by an electric arc or the oscillating tube may present a parallel with the waves produced by a fluttering sheet of water.

The dam where the phenomenon is more frequently observed—and this is due to the fact that this dam is used to discharge all the waste from Sudbury River—is 168.67 ft. in length and has a fall of water of about 11 ft. Little vibration is felt until the volume of water passing over the dam amounts to over 300 m.g.d., corresponding to a 6-in. depth of water on the crest. At one time it was attempted to mitigate the effect of the vibrations, as at least one complaint was made of rattling noises at night, by introducing timbers under the sheet of water so that air might freely enter, but this was abandoned.

Several engineers of note in charge of large dams have never had similar vibration experiences and some have never heard of its occurrence anywhere. At Lawrence, Mass., vibrations have been observed when the volume of water was sufficiently large, or when the depth of water is about 1 ft. At Lowell, Mass., the fluttering has been observed when the flashboards have been raised several feet in height and there is 6 in. of water flowing over the dam—generally with a slight breeze at the same time. Vibration has also been ob served at several vertical timber dams along the Pawtuxet River in Rhode Island—in every case where there is little or no opportunity for access of air at the ends of the dam—but the vibration has not been so pronounced as to be noticed in the neighborhood.

A more marked case has been reported from Fitchburg, Mass., where it became necessary to devise some method of preventing the trouble. The Fitchburg dam was a small concrete structure (see sketch) on the North Branch of the Nashua River, about 150 ft. long and with a maximum height of 15 ft. The vibrations were at their worst when the water was about 6 in. over the crest, and became less as the depth of flow either increased or decreased. Near this dam, the rattling of windows and general noises in the houses be-



SECTIONS OF FRAMINGHAM AND FITCHBURG DAMS

When water flowing over the dams reaches a depth of about 6 in., air vibrations occur which are transmitted for considerable distances, and sometimes rattle windows and dishes in houses. Note almost vertical downstream face of the two dams.

came so marked that the residents threatened legal action, and an engineer was called in to devise a remedy.

Probably in the cases just mentioned, the lengths of the waves propagated are comparatively long, and these, if occurring at the proper periods, would set material objects in motion and cause them to vibrate in unison with the wave period, in exactly the same manner that a sound wave causes a wire tuned to the proper period to vibrate at that period.

It may not be amiss to refer to a somewhat different variety of movement set up within a water-works system leading to complaints of inability to rest at night owing to noises set up in water pipes in dwellings. Some years ago on the Boston water-works, a complaint of this kind was made, and on investigation it was found that with a hydrant half-opened at night, in order to fill a skating pond at a public park, such a rattling occurred in the meter and pipes in a dwelling about a quarter of a mile away as to demand some relief, which was simple in this case. The tenant of this house happened to be of a sensitive organization, and alone noticed it, as no one else in neighboring houses, even after questioning, appeared to be cognizant of the phenomenon.

Membership of Boston Technical Society

According to the recent report of the executive secretary, the Affiliated Technical Societies of Boston have a total membership of 3,575 as of April 1. However, as there are a number of duplications in the affiliation the total net membership is 3,168. The distribution of members is as follows: Boston Society of Civil Engineers, 932; New England Water-Works Association, 733; Plant Engineers Club, 24; American Institute of Electrical Engineers, 581; American Society of Mechanical Engineers, 913; American Society of Civil Engineers 140; American Institute of Mining and Metallurgical Engineers, 56; Massachusetts Chapter, American Society of Heating and Ventilating Engineers, 35; and Boston Chapter, American Association of Engineers, 161.

Engineering Literature

A MONTHLY REVIEW OF BOOKS AND A LISTING OF NEW PUBLICATIONS

Hydrogen Ions

REVIEWED BY HARRY E. JORDAN
Sanitary Engineer, Indianapolis Water Co., Indianapolis, Ind.

THE DETERMINATION OF HYDROGEN IONS—By W. Mansfield Clark, M.A., Ph.D. Baltimore, Md.: Williams & Wilkins Co. Cloth; 6x9 in.; pp. 480; illustrated. $5 in United States, Canada, Mexico and Cuba; $5.50 elsewhere.

The second edition of this book shows no material textual change or addition, but more than nine hundred new references have been added to the eleven hundred appearing in the first edition [which was not noted in these columns—EDITOR]. This in itself is significant of the real importance of the subject matter of the text. Glancing over the Bibliography one realizes anew how wide and active and fruitful is the interest in this subject. The *Journals* of the American Chemical Society, of Biological Chemistry, of Bacteriology, as well as the more practical *Journal* of the American Water Works Association, rarely issue a number in which there does not appear an article based upon studies involving hydrogen ions.

The text is formidable, not in size, rather in its conciseness and strict adherence to the presentation of the scientific facts. An able critic of the first edition regretted that a few brief chapters of simplified theories were not added; many users of the text have regretted that Clark did not add a simple statement on the use of the potentiometer and on the care of electrodes. Those who know Clark realize that he will not deviate one iota from the more purely scientific and theoretical basis by any concession to the practical side. Fortunately there now exists in the literature enough information, simply stated, to guide the somewhat faltering approach, let us say, of the chemist who, instructed in the primitive empiricism of qualitative and quantitative analysis twenty years ago, finds it not easy to keep abreast of the science in its present-day form, admixed as it is with physics and mathematics.

In the field of sanitary engineering the determination of hydrogen ions has had a tremendous influence—not the least important of which has been the mental stimulus to the engineers themselves. It has done more to furnish tools for investigation and rational study of problems of sanitation than anything, perhaps, since the first plate count of bacteria was made. Naturally, there have been a few ill considered applications of these data to certain projects—in one notable case retarding the construction of a much needed water purification plant.

While the applied theories are yielding valuable information in studies of iron removal, softening, and coagulation processes, it appears that no material change in purification structures will develop. As to methods of correctly preparing water for filtration, every day in the year, as well as prevention of red water troubles in distribution systems, knowledge of Clark's text and the allied literature is of great value.

The usefulness of the next edition could be increased by expanding the Bibliography to a series of brief abstracts of the references cited, as has been done in other books. Although this would mean a lot of drudgery on the part of the author it would vastly increase the service qualities of the enlarged book.

Valuable Researches on Ventilation

VENTILATION: Report of the New York State Commission on Ventilation Appointed by the Governor of the State of New York at the Request of the New York Association for Improving the Condition of the Poor and Supported by the Milbank Memorial Fund, C.-E. A. Winslow, Chairman. New York: E. P. Dutton & Co. Cloth; 7x10 in.; pp. 620; 134 line cuts and halftones. $15.

Keep cool. This is the fundamental conclusion of this report as regards ideal conditions of ventilation. Next in order of importance is keep dry and don't worry much about over-dryness—reference here being made to relative humidity. Forget carbon dioxide *per se;* forget also in large degree organic and other impurities in air except when these go to extremes and even then regard these chiefly as having an unfavorable effect upon appetite and inclination to work. Such, in brief, are the main conclusions drawn from the interesting historical review of ventilation theory up to the date of the experiments forming Part 1 of this book and from studies on the effect of various air conditions conducted by the New York State Commission on Ventilation.

That window ventilation is the best method for school rooms is the main conclusion drawn from the many experimental and other data given in the 400 pages of Part 2 of the volume. That is, having established the main desiderata for ventilation in general, the commission devoted the major part of the rest of its studies to a consideration of how a supply of cool air, with reasonably frequent changes, can best be secured for school rooms. The Commission summed up its conclusions on this point as follows:

"In general, therefore, we are forced to conclude that window ventilation with ample direct radiation, window deflectors, and adequate gravity exhaust, seems the most generally promising method for the ventilation of a class room where local conditions permit its use." The conclusion just quoted is based principally upon studies of the sort of ventilation outlined compared with plenum and fan ventilation. Some attention is given to fan exhaust, on which the Commission has this to say: "Such data as we have obtained are not particularly promising along this line." It should be understood that these main conclusions are qualified in various ways by the more detailed discussion given in the report, and stress should be laid upon the fact that so far as window ventilation is concerned its application here is limited almost wholly to school rooms.

The New York State Commission on Ventilation was appointed some eight or nine years ago by the Governor of New York and under the other conditions stated in the heading to this notice. It serves without expense to the state.

The opening chapter of the report is a most excellent and interesting review of the historical development of knowledge in regard to the physiological influences of ventilation, compressed within a very few pages. Those who cannot read French and German will be annoyed, to say the least, by the fact that relatively extensive citations in these languages are given without translation and sometimes without any summary. Another source of annoyance—and this extends throughout the whole of the text of the volume—is the long measure employed, the lines being 5½ in. long and therefore difficult to read.

The division of the report into two main parts has already been indicated. It has also been intimated that each part contains many detailed data. These consist of minute descriptions of the experimental work conducted and the apparatus used together with tabular logs. Further details are given in an appendix.

The conclusions drawn by the Commission in favor of window ventilation of school rooms were very promptly and vigorously challenged at the annual meeting of the American Society of Heating and Ventilating Engineers at Chicago in May, and the president of the society was authorized to appoint a committee to consider the report and submit recommendations regarding it at the next annual meeting. (A brief summary of the discussion may be found in *The Heating and Ventilating Magazine* for June.) It was urged during this discussion that (quoting from the magazine just named) "the Commission had exhausted its funds before completing its work and that the story might have been very different if the plans, as originally outlined, of testing school buildings under a wide variety of conditions, had been carried out." It should be noted that one of the members of the Commission, D. D. Kimball, New York City, is a member of the society.

An important point not yet mentioned regarding the conclusions of the discussion is that observations over some weeks of time showed 18 per cent more absences due to respiratory illness and 70 per cent more respiratory illness among children in the "warmer fan-ventilated rooms" than in the window-ventilated rooms, even though the latter had less per capita floor space than the former.

The report as a whole is a most valuable piece of work and will repay study. Good summaries are given at the end of each chapter. These will enable anyone who cannot read so voluminous a report in detail to get the main results and conclusions in a short time.

An Engineer's Brief for a Stable Dollar

EVERYBODY'S MONEY: What It Is, What It Does and What Should Be Done with It—By Ernest McCullough. New York: G. P. Putnam's Sons. Cloth; 6x8 in.; pp. 175; two plates of line cuts. $1.75.

After writing a considerable number of books on engineering and closely allied subjects, and after war and post-war experience of the evils of inflation and deflation, Mr. McCullough has attempted what may perhaps be best and most briefly described as a popular exposition of Prof. Irving Fisher's plan for Stabilizing the Dollar—recently set forth by the latter in a book bearing the title just quoted and also embodied in a congressional bill. The Fisher plan proposes basing the amount of gold in a standard dollar on a price index, the index to be computed six times a year and the number of grains in a dollar and also the number of dollars in the treasury to be changed accordingly.

To lead up to his final chapter on The Natural Standard of Value, the author reviews briefly, with many apt illustrations, both homely and statistical, the following main topics: Prices and value, money—metal, paper and bank—foreign exchange, war inflation, the business cycle and the price index. A point urged repeatedly throughout is that the voters of the country should gain a knowledge of the fundamentals of the subject and then take the whole matter of stabilizing money out of the hands of the politicians and the speculators, insofar as both classes are to their own profit making use of instability and proffered remedies. That is, Mr. McCullough would have the voters see to it that their representatives in Congress enact legislation for the Fisher plan, or some other plan that would substitute a stable for a "dancing dollar."

The vital importance of the subject and the brevity and clarity of the treatment make the volume deserve a wide reading while the fact that the author is an engineer should give it particular interest to members of the engineering profession.

New Treatise on City Pavements

CITY PAVEMENTS—By F. S. Besson, Major, Corps of Engineers, U. S. Army; Assistant Engineer Commission, District of Columbia. New York and London: McGraw-Hill Book Co. Cloth; 6 x 9 in.; pp. 421; 199 line cuts and halftones $5.

A quite different line of approach to a discussion of city pavements has to be pursued today than was followed in the older familiar treatises on pavements. Paving materials and pavement construction are still important factors, but the problem of paving a city has been made much more complex by questions of street-system planning, zoning of streets, and weight and volume of traffic. This changed situation is exemplified well in the most recent of treatises on city pavements by Major Besson. Of the 400 pages 100 discuss organization, records, contract practice, street systems, pavement selection, and detail design. It is in these first 100 pages that the engineer old in the service of city street departments will find his greatest inspiration.

Of the three other major divisions of the book one is devoted to bituminous pavements and one to block pavements and the third to concrete, which is the base for both bituminous and block surfaces. In each of these three divisions the plan of presentation, in from four to seven chapters, is (1) materials and tests; (2) design of mixtures; (3) construction plants and methods. Generally the requirements of the American Society for Testing Materials in respect to materials and tests are followed by the author. In discussing concrete mixtures the modern theories of proportioning by fineness modulus and surface area are given along with the methods by voids and proportioning by tables. This chapter on the design of concrete mixtures and that on the design of bituminous mixtures are among the most useful portions of the volume.

Altogether, however, the city paving engineer will get most of value from the sections on administration and management and on planning and design. Major Besson favors a military organization in street administration and emphasizes the use of plans and records. These include topographic, highway-plan and work-progress maps; street, alley and measurement sheets; maps, cost and traffic records. Contracts are fully discussed and

the chapters on street systems, selection of pavements and street and pavement design are notable contributions to the information available to the street and pavement engineer.

Highway Motor Transportation

MOTOR TRANSPORTATION OF MERCHANDISE AND PASSENGERS—By Percival White, Research Engineer; Formerly Manufacturer of Projecta Cars, London, England; Director of Development, Aluminum Manufacturers, Inc., Cleveland, Ohio; and Ordnance Expert, War Department; M. Am. Soc. M. E., Soc. Automotive E., etc. New York and London: McGraw-Hill Book Co. Cloth; 6x9 in.; pp. 486; illustrated, $4.

Highway engineers have need of a general treatise on motor transportation, which it has been the purpose of the author of this to produce, rather than of manuals discussing in more detail single phases of the subject. No engineer of highways is today in a position to plan broadly and to design efficiently without a general knowledge of traffic, of the vehicles which act on the highways and are reacted on, and of transport relations and development, but he does not want details which concern only the automotive engineer or the bus-line manager. Naturally the text is directed more particularly to the manager of motor transportation than to the highway engineer, but even in the discussion of transport problems specifically, as vehicle design and maintenance, operating organization, routing and scheduling traffic, accounting and insurance, the treatment has, because of the extent of the subject, to be confined to presenting general principles and conclusions which hold interest to the highway engineer.

In presenting his discussion the author aids the reader by an introductory chapter in which are described the outstanding aspects of motor transport which are considered in detail in the succeeding chapters, and by outlines heading each chapter. Both were found by the reviewer a distinct aid in visualizing the plan and contents of the volume and in co-ordinating his ideas later in the more careful reading of the several chapters.

Of the twenty-seven chapters, five relate to the design and maintenance of vehicles, eleven to such fields of freight and passenger service as express haulage, bus operation, etc., and the others to general questions of administration, operation and accounting. Highway engineers will be particularly interested in the chapters on the truck and the railroad, on truck legislation, and on insurance. It is, however, as a general picture of highway motor transportation which the highway engineer needs to visualize that the volume offers most of value.

Trade Associations Explained

TRADE ASSOCIATION ACTIVITIES—Prepared by L. E. Warford and Richard A. May Under the Direction of Julius Klein, Director, Bureau of Foreign and Domestic Commerce. Washington: Superintendent of Documents. Paper; 6x9 in.; pp. 368. 50c.

Much has been heard about the trade association in the past few years. Owing to the inquisitive notice of them taken by the Department of Justice and the condemnatory mention several of them have had by the United States courts, they cannot be said to be very much in favor at the present time. It is a fact, though, as Secretary Hoover says in the preface to this government report on such associations, that their "constructive purposes unfortunately have been confused with the minority of activities which have been used as a cloak for action against the public interest."

The report is, therefore, a welcome corrective. It is intended, according to Mr. Hoover, "to present a picture of the organization, administration and operations of trade associations with a view to meeting the need for public information on the subject and, further, in order that a business facility which is economically useful, when properly conducted, may not suffer discrimination by reason of misapprehensions regarding its purposes and accomplishments." It contains, in addition to the introduction, which outlines the problems and the activities of trade associations, chapters written by various specialists on statistics, legislative activities, standardization, accounting, trade disputes and ethics, employee and public relations, insurance, public relations, traffic and transportation and research. There are, in addition, chapters explanatory of the functions of the government in assisting trade and a suggested form of organization for associations. Appendices contain some historical notes and a directory of such associations as now exist.

The book is the result of an investigation undertaken jointly by the Bureau of the Census, Bureau of Foreign and Domestic Commerce and the Bureau of Standards. It was guided and supervised by a committee headed by F. M. Feiker. Among the other members of the committee were: E. W. McCullough, Chamber of Commerce of the United States; S. L. Nicholson, Electrical Manufacturers' Council; Alfred Reeves, National Automobile Chamber of Commerce; and Nathan B. Williams, National Association of Manufacturers. L. E. Warford was secretary of the committee.

Pioneer British Regional Planning Work

THE DONCASTER REGIONAL PLANNING SCHEME: Report Prepared for the Joint Committee by Patrick Abercrombie, University of Liverpool, and T. H. Johnson, Doncaster, Together with an Appendix on Coal Subsidence by Joseph Humble, Doncaster. London: Hodder & Stoughton, Ltd., for the University Press of Liverpool. Paper; 10 x 12 in.; pp. 93; plates of half tones and maps and colored folding maps. 10s. net.

City planners in America and elsewhere who have been engaged of late in promotional or actual regional planning work will find this report interesting and suggestive. It deals with a part of England that only of late has begun to change from a rural area with Doncaster as its center and a few scattered hamlets and villages to what promises to be a hustling mining and manufacturing district. Doncaster and possibly some of the smaller places have not only begun town planning but have also had the vision and initiative to take up regional planning as well.

Doncaster and other local authorities in the new coalfields district near Sheffield and Leeds, England, on being convened by the Ministry of Health in January, 1920, to consider industrial development in that section, formed a joint town-planning committee composed finally of representatives of nine local government areas. This committee, with the clerks and the surveyors of the several communities, and with the aid of the specialists named above, have produced what Prof. Abercrombie in his Introduction describes as the "first regional planning scheme to be prepared," presumably meaning in England. Reference is made to the South Wales Regional Survey noticed in these columns, Nov. 16, 1922, p. 850, as a demonstration of the need of a plan.

Zoning along unique lines following topography and taking into account land subsidence and other problems incident to a colliery region is a notable feature of the

regional planning scheme. The committee outlines a plan, having as its "general aim" a dozen "self contained and well-defined towns" with Doncaster as the "capital town" and with the intervening areas given up to "agricultural land, small holdings, allotments and playing fields." Three zones are proposed: (1) Industrial, comprising certain low-lying lands; (2) agricultural or industrial, with prohibition of new dwellings "except what are absolutely essential for local agricultural purposes, this zone to comprise land below the 25-30-ft. contour, the exact line to vary with local conditions; (3) a neutral zone, above the 25-30-ft. contour, usable for either housing, commerce or clean industry . . . well-balanced communities being planned as the type of suitable local development becomes apparent." Maximum building heights of 76 ft. for all but the industrial zone are proposed, but with no part of any building projecting "above a line drawn from the center of the street in front at angle of 56 deg. with the horizontal."

Other subjects covered by the report are preservation of certain villages, places of natural beauty and of ruins; road widenings and extensions, including much-needed ring roads, and the fixing of building lines; better railway facilities as regards local traffic (the district already has a notable system of through railway lines, as it has also through highways); improvements of the three waterways of the district; also the provision of civic centers and of regional parks.

The suggestions for regional parks show a timidity that seems to be only partly excused by uncertainty as to the location and needs of future development and the general lack of areas which thrust themselves forward for being set aside because of their eminent fitness as parks and reservations.

From the viewpoint of present-day knowledge of the origin and control of diphtheria one sentence in the report seems inexcusable. In this sentence it is stated that a health survey of the Doncaster region "would probably show that in certain villages in the flood lands such terrible diseases as diphtheria may be said to be endemic." This is incidental and immaterial, so far the main purposes of the report are concerned, but the appearance and usefulness of the many regional plan inserts is damaged by failure to letter the originals for reproduction. The result is that without a magnifying glass most of the lettering on these maps cannot be read. The same is true of the names of minor places on the large colored folding maps at the back of the report.

Finally, the Doncaster regional plan is a commendable piece of work. The report will repay study by city and regional planners everywhere.

PUBLICATIONS RECEIVED

Notes on Pamphlets and Reports

EXCELLENT PAPERS BY LEADING HIGHWAY ENGINEERS are given appropriate dress in the well-edited and handsomely-printed Proceedings of the 1923 convention of the American Road Builders Association. Too commonly the technical society report is a poor example of book-making with little if any editing beyond the clerical process of assembling the material in order of presentation at the convention and correcting the most obvious errors of the convention stenographer. It is in being the direct opposite of these things that this report deserves study by association secretaries and publication committees. It is edited as a high-class technical journal or a scientific book is edited and typography and illustrations are co-ordinate elements of the editorial plan. It is bound and printed in the manner of the better-class engineering books. It is a credit to the growing organization which publishes it.

RARELY DOES A TECHNICAL SOCIETY publish its convention proceedings within less than two months of the date of its meeting, as has the National Conference on City Planning this year. The meeting closed on May 2; the *Proceedings* were out by June 20. (Flavell Shurtleff, secretary, 130 E. 22nd St., New York City; $2.25.)

NEARLY A MILLION TRADE UNION MEMBERS (actually 861,893) are covered in the eleventh annual bulletin of the Bureau of Labor Statistics on Union Scale of Wages and Hours of Labor, May 15, 1922. Figures are given for 66 of the chief cities of the United States, with comparative figures for May 15, 1921, and with summaries by trades going back to 1907. In view of the importance of this and related labor and industrial problems it is a pity that these figures are a year old on publication.

IT PAYS TO GIVE VACATIONS WITH PAY to both office and factory employees according to conclusions drawn from data given in "Employee Vacation Plans." Reports from many manufacturing, commercial, financial and other concerns are briefed separately and 121 vacation plans for (1) executive and office forces and (2) factory employees are summarized in two small tables. (Boston, Mass.: Bloomfield & Bloomfield, Consultants in Industrial Relations; $1.50.)

AIRWAYS AND LANDING FACILITIES are the subject of a 112-p. illustrated pamphlet recently prepared by the Office of Chief of Air Service, Washington, D. C. While the information is primarily for pilots of air craft some portions of the text are of interest to engineers, particularly those relating to the location, size and construction of air terminals and landing fields. The circular contains a list, by states, of landing facilities throughout the country.

THE POPULATIONS of the 542 incorporated cities of Kansas and the officials of 514 of the cities, together with lists of the 11 cities having managers and the 46 cities under commission government are given in Bulletin 41 of the League of Kansas Municipalities. (Lawrence, Kan.; $1.)

PUBLIC UTILITY RATES FOR 542 KANSAS CITIES, as of Jan. 1, 1923, contains quite a bit of other information regarding 255 municipally- and 6 privately-owned waterworks; 237 public and 179 private electric plants; 7 public and 109 private gas works and 590 telephone stations. (Lawrence, Kan.: League of Kansas Municipalities; $2.50.)

REHABILITATION OF THE NEW ENGLAND RAILROADS and the operation of them as a regional system is proposed by report of the Joint New England Railroad Committee to the Governors of the New England states, as preferable to consolidation with one or more of the large eastern systems. An abstract of this report appears elsewhere in this issue.

IRON AND STEEL STATISTICS, 1919-21, for the British Empire and Foreign Countries and copper statistics likewise are available in pamphlet form. (London: His Majesty's Stationary Office; 1½s. and 3s. net.)

A SPOT MAP OF THE 312 CITIES in the United States and Canada known to have city managers is a feature of the 1923 Year Book of the City Manager's Association (Lawrence, Kan.: John G. Stutz, secretary; 50c.).

VESTNIK PRO VODNI HOSPODAVSTVI (Review of Water Economy) is the name of a periodical issued by the government of Czechoslovakia. Similar publications from other countries are desired by the editor, Ing. Josef Vrba, secretary, Ministry of Education and private professor at the Czech School of Technology, Prague.

STATISTICS OF INCOME for the calendar year 1921 have just been issued by the Commissioner of Internal Revenue

(Washington, D. C.) as a preliminary pamphlet report devoted to personal income tax returns alone. It has some very interesting information regarding distribution of income by classes and localities.

A MONOGRAPH ON EXPLOSIVES designed to meet the lack of a comprehensive work on the subject has been issued by the Bureau of Mines. The authors are C. A. Taylor and W. H. Rinkenbach and the title is Explosives: Their Materials, Constitution, and Analysis. (Washington, D. C.; pp. 185; one copy free; additional copies 20c. from Superintendent of Documents.

RECONNAISSANCE AND SIGNAL BUILDING, by Jasper S. Bilby, Signalman, U. S. Coast & Geodetic Survey, supplies "information on a subject not fully treated in any previous manual of the U.S.C. & G.S." (30c. from Superintendent of Documents, Washington, D. C.)

CONFERENCES ON SEWAGE TREATMENT have been held annually for four years at Iowa State College, Ames, Iowa, under the auspices of the Engineering Extension Department. Among the six papers read at the 1922 conference and now available as a department bulletin, are The Role of Bacteria in Sewage Purification, by Prof. Max Levine, and The Activated-Sludge Process, by Prof. Edward Bartow.

OUR LUMBER PRODUCTION DECLINE is strikingly shown in the Lumber Cut of the United States, 1870-1920, by R. V. Reynolds, Forest Examiner, and Albert H. Pierson, Statistician, in Forest Products, U. S. Forest Service (pp. 63; illustrated). The cut for 1920 was 27 per cent below the peak production of 1907, and 2.2 per cent below the 1919 cut.

ZONING IS RECEIVING SO MUCH ATTENTION just now as to make two new pamphlets on the subject welcome. In Present Attitude of Courts Toward Zoning, Edward M. Bassett, Counsel, Zoning Committee, New York City, presents a review that would be useful wherever zoning ordinances are being framed or in litigation. Regional Zoning, by Robert Whitten, city planner, Cleveland, Ohio, reviews the extension of zoning to whole districts. (National Conference on City Planning, 130 E. 22nd St., New York City.)

New Books and Revised Editions

ACOUSTICS OF BUILDINGS: Including Acoustics of Auditoriums and Soundproofing of Rooms—By F. R. Watson, Professor of Experimental Physics, University of Illinois. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. 155; 72 line cuts and halftones. $3.

CARATTISTICHE COSTRUTTIVE DELLE TURBINE IDRAULICHE Negl' Impianti Attuati—By Ing. Guido Gambardella. Milan, Italy: Antonio Vallardi. Paper; pp. 133; 17 line cuts.

According to the author's preface, this is not a textbook but rather an attempt to connect recent theory with current practice, showing the relation of recent studies and laboratory tests to methods of construction and installation in use in Europe and America. It is intended to be a guide for students as to the theories now actually put into practice; and for manufacturers in selecting the type of turbine best suited to their needs.

CROWELL'S DICTIONARY OF BUSINESS AND FINANCE—New York: Thomas Y. Crowell Co. Cloth; 6x9 in.; pp. 605. $3; postage extra.

Definitions, mostly short, of thousands of words and expressions current in business and finance and associated law.

FOUNDATIONS, ABUTMENTS AND FOOTINGS—Compiled by a Staff of Specialists; Editors-in-Chief; George A. Hool, S.B., Consulting Engineer, Professor of Structural Engineering, University of Wisconsin, and W. S. Kinne, Professor of Structural Engineering, University of Wisconsin, Assisted by Horace S. Baker, S.B., Chief Engineer, Frank D. Chase, Inc., Chicago. New York and London: McGraw-Hill Co., Inc. Cloth; 6x9 in.; pp. 414; illustrated. $4.

PRACTICAL RAILWAY MAINTENANCE—By Charles Weiss, C.E. New York and London: McGraw-Hill Co. Cloth; 6x9 in.; pp. 349; illustrations and tables. $3.50.

THE DESIGN OF STEAM BOILERS AND PRESSURE VESSELS—By George B. Haven, S.B., Professor of Machine Design, Massachusetts Institute of Technology, and George W. Swett, S.B., Associate Professor of Machine Design, Massachusetts Institute of Technology. Second Edition, Revised. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Limited. Cloth; 6x9 in.; pp. 435; 206 illustrations. $4.

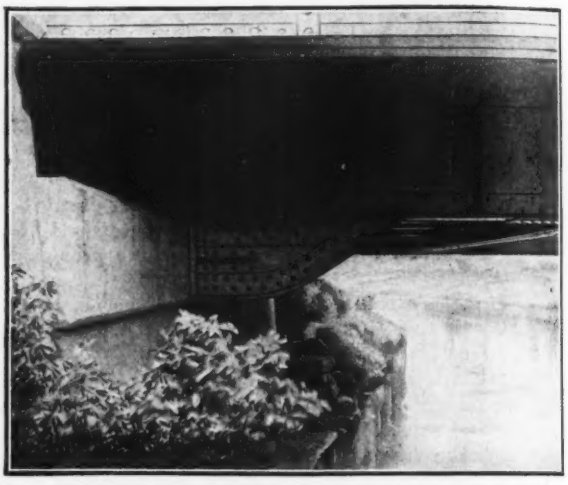
Nineteen pages of text and six illustrations have been added to the present edition. There is a new chapter on "the logical design of a water-tube boiler." The first edition was favorably reviewed by William H. Boehm, of the Fidelity & Casualty Co., in *Engineering News*, June 15, 1916, p. 1135.

Bronx River Bridge Abutment Held by Girder Brackets

BY ARTHUR G. HAYDEN
Senior Assistant Engineer, Bronx Parkway Commission, Bronxville, N. Y.

THE May 31 issue of *Engineering News-Record* reports on p. 971 the use of brackets on a deck plate-girder bridge of 34-ft. span near Vienna, Austria, to prevent the overturning of yielding abutments. It may be interesting to know that the same device was used on a Bronx Parkway bridge two years before the Austrian example.

Development of the parkway necessitated moving the channel of the Bronx River in the vicinity of the New York Central R.R. station at Mount Vernon, N. Y., westward about 60 ft. Sherwood Ave. Bridge crosses



GIRDER BRACKET TO HOLD ABUTMENT

the river at this point, and the bridge was moved west to span the new channel. The old east abutment was abandoned and the old west abutment was used as the east abutment (Abutment B) of the relocated bridge, a new west abutment being built. The new river channel was excavated back of Abutment B, and the old channel filled in front of it.

It is thus seen that the direction of the earth thrust on the abutment was reversed, and the abutment was not safe for this condition. The resultant pressure line, including the bridge reaction, came near the edge of the base. Addition to the abutment to increase its stability would have been expensive and unsightly. Therefore the scheme was devised of supporting the abutment against overturning by means of brackets attached to the bottom flanges of the girders.

The brackets were adjusted with slight clearance at high temperature, so as to avoid temperature stresses in the girders due to expansion. Thus, no load will be imposed on the girders unless the abutment actually yields. If this does occur, the abutment will be braced against the new west abutment by means of the brackets at either end of the girders. Calculation shows that the maximum possible load from the brackets might reverse the dead- and live-load stresses in the girders near end of span, but would not exceed safe limits.

Sherwood Ave. Bridge is a four-girder bridge of 55-ft. span with concrete floor, and carries a 32-ft. roadway and two 7½-ft. sidewalks.

Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

Building Height Restriction

Sir—In your issue of July 12, 1923, p. 45, you attempt to discuss "Building Height Uncertainties." Evidently the writer of the editorial has been Rip Van Winkling in municipal affairs for several years past.

He admits that "half a dozen cities have concerned themselves with the question in recent months." Ten times that number would be more accurate. Any city or village that takes up the question of zoning in a comprehensive way must consider height regulation. There are now 145 municipalities of all sizes in this country that have adopted zoning ordinances and nearly that many others have zoning under consideration.

It is hard for a New Yorker to believe, but in that vast unknown territory stretching west from the Hudson River there are quite a number of people. They are not all Indians, either. About a thousand miles west of the metropolis there is a place called Chicago that is nearly half as big as New York. Thirty years ago that village started to regulate the height of its buildings and is still doing it.

"Nowhere, however, has substantial reasoning been brought to bear on the problem. So far as can be judged, esthetic notions are leading factors in the discussion." Rot! If you are to write more for the edification of those interested in municipal problems, you should read up. As a starter on "Heights" read "Studies on Building Height Limitations in Large Cities," by The Chicago Real Estate Board.

A. H. C. SHAW,
Engineer, City Planning Commission.

Columbus, Ohio, July 14, 1923.

Backfilling to Avoid Settlement

Sir—It has been the practice of contractors, corporations, and plumbers, who have occasion to open streets, to place the backfill in such a manner as to cause a mound of earth over the opening, which after a few rains generally sinks into a deep depression, leaving holes in paved streets, which remain in bad condition for a long period of time, causing great inconvenience in the use of the highway, breaking automobile springs and causing accidents.

In order to avoid these conditions, the following procedure, which has been followed by the Office of the President of Manhattan of the City of New York for the past eight years, is recommended.

It is reasonable and advisable to hold the one who makes the opening responsible for its backfilling in such a manner as to avoid settlement. This is the basis of the system proposed. It is accomplished by requiring the contractor, plumber, or corporation who makes an opening to guarantee that there shall occur no settlement in the refilled opening for six months after backfilling. In contracts with the city sufficient money is held back for six months to cover the cost of repaving if it should become necessary. Corporations are required to furnish bonds, and are charged twice in case the repaving of the filled opening becomes necessary within six months. Plumbers are required to deposit a sum equal to twice the estimated cost of repaving. This money is held for six months, and if the filled area is required to be repaved a second time, the work is done by the city and charged against the plumber. If, however, his fill has been made so well that no settlement occurs after six months, he is refunded the balance of his deposit.

Each permittee who opens a street has a financial interest in backfilling in such a manner as to avoid settlement. Eight years' experience in the Borough of Manhattan has demonstrated that by this simple means the backfill is generally done with proper care, and a great saving to permittee and the public generally is effected.

When it becomes necessary to open a public street, application is made at the office of the President of the Borough or the Public Works Office of a city for a permit. An application blank is furnished which contains a statement of the conditions under which the permit is granted, and clearly sets forth the conditions with reference to backfill and double payment therefor. Separate forms are used for corporations and for general permits.

Upon filing the application the permittee is required to make a deposit of twice the estimated cost of paving the opening. This has been estimated in Manhattan as follows:

Opening for water in sheet asphalts	16 sq.yd. @	$5.00	$1 for permit	$81.00
Opening for sewer in sheet asphalts	24 sq.yd. @	5.00	1 for permit	121.00
Opening for water in wood block	16 sq.yd. @	6.00	1 for permit	97.00
Opening for sewer in wood block	24 sq.yd. @	6.00	1 for permit	145.00
Opening for water in granite on concrete	16 sq.yd. @	3.60	1 for permit	58.60
Opening for sewer in granite on concrete	24 sq.yd. @	3.60	1 for permit	87.40
Opening for water in granite on sand	16 sq.yd. @	1.00	1 for permit	17.00
Opening for sewer in granite on sand	24 sq.yd. @	1.00	1 for permit	25.00
Opening for water in macadam	16 sq.yd. @	2.00	1 for permit	33.00
Opening for sewer in macadam	24 sq.yd. @	2.00	1 for permit	49.00

At the time the permit is issued, a report is made up on a special form.

To introduce this system into any other municipality the area will be divided into inspection districts. In Manhattan the districts are such that each inspector is enabled to cover every street in his district at least once a week. A portion of the permit report goes to the district inspector, and the remainder is filed at the office as a tickler. The form contains a page for a preliminary report, and one for a final report, which is made six months after the pavement has been first replaced. Upon this report is based the refund to the permittee. The conditions agreed to by the permittee require that the pavement be replaced within 64 hours after notice by the inspector that the backfill has been completed. In highway contracts that provide for maintenance, a clause is included which provides that cuts must be refilled by the contractor at a stated price within 64 hours after notice by the Commissioner of Public Works of the Borough. When the pavement is replaced by the contractor under the maintenance clause, the report of the area is made by the district inspector, and the permittee is charged with the contract price, plus the cost of the inspection. Where the replacement is made by the city force, record of the actual cost is noted and turned in by the inspector on special forms provided. In these reports the quantities of material used, the labor, and the area repaved is recorded, and forms the basis for the charge against the permittee in a ledger account which is kept in a daily permit ledger which is arranged according to the permit numbers, and gives the exact charges and credits against the permit until entirely satisfied after each six months' replacement. This ledger shows the cost of the original replacement, and any additional costs for an additional replacement, as well as the sum deposited by the permittee. The balance due the permittee is also recorded, and the sum he is allowed to liquidate by application to the Comptroller upon certification of the Commissioner of Public Works that the account is ready for liquidation, having passed final inspection, is the balance shown upon this ledger.

By the tickler system, at the expiration of six months the inspector is notified to report upon the condition of the opening which report is made upon a special form.

The application of this system depends upon frequent and efficient inspection, without which it would fail. It is believed, however, to be as good a system as can be recommended, if strictly enforced, and is applicable to any city where the one who makes a street opening is required to pay the cost of repaving the opening.

LOUIS B. MANHEIMER,
Assistant Engineer, City Planning Bureau,
Borough of Queens, City of New York

Long Island City, N. Y.,
July 1, 1923.

How to Get Apprentices

Sir—Your editorial "Who Restricts Apprentices?" in the issue of July 12, 1923, p. 45, is very much to the point. It directly touches a point familiar to all interested in building work from its many angles. The condition in New York certainly must be typical of the general condition throughout the country.

It is not possible for one man to find or fix a cure for the existing condition. However, if a sufficient number of people throughout the country would think about this condition and then act, first by publishing their opinions, then by following their publications by co-operative action, some definite results could be obtained. For instance, in our local territory, and we serve in and throughout Maryland, parts of Pennsylvania and West Virginia, the lack of apprentices in the various trades cannot be blamed entirely upon unions or contractors or that portion of the younger generation from which apprentices are usually drawn, but all are responsible. It would be foolish to claim that union rules control the number of apprentices when there are not sufficient apprentices to fill the vacancies which are at present in existence.

Take the situation in our own city of Cumberland, there are no apprentices available for the bricklayers' trade, we know of no apprentices in the plasterers' trades, and so it goes throughout all of the various building trades. It would be foolish to blame the lack of apprentices on the contractors of this city because there is sufficient co-operation between contractors and the various unions to insure completion of any job and incidentally to insure placing of any available apprentices. Also the contractors would be cutting their own throats if they did not endeavor to bring prospective apprentices to the notice of the various unions.

It will be recognized as a fact that the young people of the present age are more interested in dancing and white-collar jobs, so-called, than they are in such work as bricklaying or any other mechanical trade. In every college there are students trying to be lawyers, architects, or other professional students who could better be plumbers, bricklayers or mechanics. If every college were fitted with a mechanics or trades department a portion at least of these students who find they are fitted for a mechanical line or discover their ambition while students could very readily take up their choice of studies in the college in which they are entered. Then, too, the proper incentive of a large percentage would be put before them at a time when it would do the most good. Many young men who start out in life experience several changes of vocation in the first four years of business life. This, of course, does not hurt them but gives a valuable knowledge of men and conditions. It only delays the individual in the finding of a proper and suitable vocation for which he is most suited. This thought was confirmed by a recent editorial in your paper wherein it was stated that a large number of men were going back to or into the trades.

It seems, therefore, to be up to all concerned to encourage the mechanically inclined to choose a trade at an early day in life. If all of the boys graduating from technical or mechanical, engineering or architectural, courses would serve from three to four years in any one of the building trades before taking up their engineering vocation, the need for apprentices would constantly be met and these young men would then have a practical and efficient foundation for their chosen vocation in their respective professions.

The answer to "Why is a student?" is probably that said student desires or has the ambition to get above the other fellows and so studies for a number of years to get himself there by the quickest road, but the true student is a life student and therefore four years spent in practical work in any trade would not be a handicap, and incidentally the average mechanic now commands more during his apprenticeship than the average engineer in the first year of his career. The worthy apprentice will eventually rise above the trade, especially those who have been through a higher college and obtained a degree, and all of them will be more efficient and capable for the experience gained during their apprenticeship.

J. B. BROWER, JR.,
Architect.

Cumberland, Md., July 14, 1923.

High Cost of Detours

Sir—High cost of detours in constructing roads in Wisconsin is analyzed in an impressive manner by N. M. Isabella in your issue of June 21, p. 1088. The subject is one to which very inadequate attention has thus far been given and it is to be hoped that Mr. Isabella's presentation and your editorial comment will go far toward giving the subject its proper place in the economics of road construction.

Mr. Isabella's estimates are quite conservative; in fact too conservative. He makes no estimate as to the cost of maintaining detours in passable condition or as to the increased cost of operating the motor vehicle over detours due to bad grades and unsatisfactory road surfaces. These items would undoubtedly swell the total considerably to say nothing of the time loss and annoyance to users.

In suggesting the methods of reducing the penalty imposed upon the traveling public Mr. Isabella entirely omits the one mathematically certain method of reducing the detour period, namely, that of changing the type of construction from portland cement concrete to a type which does not have to be shut off from traffic while it is curing. As stated by Mr. Isabella fourteen days are required for this curing process in Wisconsin and in some other states as high as twenty-one days are required for this purpose. Asphaltic concrete on the other hand may be thrown open to traffic upon its completion. Fourteen days cut from the 81.6 days average mentioned by Mr. Isabella would result in a saving of $630,000 and if there is any merit to my statement that additional costs are involved in the maintenance of the detours, in the increased operating cost of the motor vehicle and in the lost time by the road users it may reasonably be stated that the substitution of asphaltic concrete pavements would result in a saving of $1,000,000 in the item of detours alone. What is true of Wisconsin is true of any other state and it must be quite evident that the detour penalty we are placing upon our traffic throughout the United States runs far up into the millions of dollars.

If the asphaltic concrete type of pavement were experimental I should not make the suggestion that it be considered. It is a matter of service record that this type of pavement has been in use for upwards of forty years. In the City of Visalia, California, is a pavement of this type laid in 1894 which has cost nothing for maintenance and is now in excellent condition. Millions of yards of this type have been laid on the Pacific Coast and while it has not been extensively used in the East, remarkable results have been obtained where it has been laid. In Erie, Pennsylvania, a section which had been down over thirty years and which was in good condition was recently taken up on account of changes in underground service.

Because of its flexibility and its water-resistant quality the asphaltic concrete pavement is seldom laid to a total of more than 6 in. The usual thickness is 5 in. made up of 3-in. base and 2-in. asphaltic concrete top or 3½-in. asphaltic concrete base and 1½-in. sheet asphalt top. Where the subgrade is of a water holding soil it is customary to lay a course of 3 or 4 in. of broken stone. This would be desirable on some of Wisconsin's roads but on the whole it should be possible to adapt this admirable type to the Wisconsin program with little increase in the construction costs.

Apart, however, from the merits of the asphaltic or portland cement concrete types of pavement it can scarcely be contested that the item of detour costs should certainly be taken into account in the selection of a type of pavement rather than to be considered after it is too late to weigh it as an economic factor in the selection of type.

I make the foregoing suggestion not in a spirit of criticism of the portland cement concrete type of pavement but because I believe the highway engineering profession and the tax-paying public will profit by a discussion which will bring out the economics involved in this phase of road construction.

J. E. PENNYBACKER,
Secretary, Asphalt Association.

New York, July 3.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

News Brevities

The Public Service Corp. of Quebec has announced that the name of the Quebec Railway, Light, Heat & Power Co. will be changed to the Quebec Power Co., and its capital increased from $3,000,000 to $10,000,000. No information is at present available as to why this increase in capital is being made.

Judgment of $161,187.31 to the C. S. Lambie Co., engineering and contracting firm, Denver, Colo., has been granted as money due on contract for the large reinforced-concrete building erected by Lambie for the L. R. Steel Co., the company going into the hands of a receiver about the same time that the building was completed.

A preliminary permit and license to develop 360,000 hp. on the Susquehanna River near Conowingo, Md., has been granted to the Susquehanna Power Co. by the Federal Power Commission. The preliminary permit gives the company priority over other interests which might seek rights to develop this power. If the final permit is approved the development, which calls for an expenditure of approximately $30,000,000, will be started at once.

The Milwaukee Harbor-Rail Committee was organized by the Milwaukee Harbor Commisson on the recommendation of the Milwaukee chapter of the American Association of Engineers, not at the request of the Milwaukee Society of Engineers as stated in *Engineering News-Record* May 31, 1923. J. A. B. Tompkins, representing the Harbor Commission as its consulting engineer, is chairman of the committee.

The Hudson & Manhattan Railroad Co., has declared its first half-yearly dividend of 2½ per cent on its preferred stock. This railroad which operates two tubes under the Hudson River between New York and New Jersey was constructed at an average cost of $3,500,000 a mile. Recent large increases in the passenger traffic and an increase in fares granted by the Interstate Commerce Commission are responsible for this improvement in the railroad's financial condition.

To Help Relieve Traffic Conditions in New York City the parked strips in the center of Park Ave. are to be narrowed from 56 to 20 ft. by taking 18 ft. off each side. The narrowing will extend for the eleven blocks from 46th to 57th St. An appropriation of $1,661,000 for the work was made by the Board of Estimate the latter part of June. The high cost is said to be due to the necessity of carrying supports for the roadway to the track level of the New York Central some 40 ft. below. The sub-surface work will be done by the railway.

Pinchot Vetoes Engineers' License Law Repeal Bill

On July 12 Governor Pinchot of Pennsylvania vetoed the bill passed by the recent session of the Pennsylvania Legislature repealing the engineers' registration and license law.

R. H. Keays Is Chief Engineer of Moffat Tunnel Commission

R. H. Keays has been appointed chief engineer of the Moffat Tunnel Commission; and Major L. D. Blauvelt, state highway chief engineer of Colorado, has been added to the consulting board of the Commission, the other members of which being D. W. Brunton, J. V. Davies, and J. Waldo Smith.

Mr. Keays was assistant general superintendent for the Ulen Contracting Corp. on construction of the Shandaken Tunnel for the Catskill water supply of New York City. He was born in 1874 and is a civil engineer graduate of Cornell University. He spent several years in Porto Rico and Cuba and was, in 1900, in direct charge of the design of the sewer and water systems of Havana. Previous to that he was an instructor in mechanics and hydraulics at Cornell University and engineer on field work on Hydraulic surveys and sewer systems in New York State.

Hirst-Potts Hearing on Trenton Sewage Works July 24

The charges brought against Clyde Potts, an engineer-member of the New Jersey Board of Health, by H. Jerome Hirst, of the Direct-Oxidation Disposal Corp., alleging that Mr. Potts held up the Trenton sewage-works plans because he was refused stock in the company, will be heard by the Board at Trenton, July 24, at 10:30 a.m., daylight-saving time.

Order Restraining Shopmen in Strikes Made Permanent

A sweeping temporary restraining order, affecting 400,000 railroad employees and officers of the shop crafts unions, has been made permanent by the final decree by Judge Wilkerson of the Federal District Court in Chicago. "The significance of the order," says Attorney General Daugherty, "is not its application to the present shopmen's strike, which theoretically is still in existence, but in its effect on future strikes as a matter of precedence. It not only enjoins the strikers from interfering with railroad properties, but also enjoins them from interfering with the railroads' business, from picketing, from parades and meetings, letters, telegrams, telephone messages or any other acts that would interfere with or incite against the operation of the railroads."

Am. Soc. C. E. Protests Removal of A. P. Davis

Convention Adopts Resolutions Against Converting Reclamation Service Into Political Machine

In protest against the summary dismissal of A. P. Davis from the position of director of the U. S. Reclamation Service, the American Society of Civil Engineers at its annual convention in Chicago, July 11, adopted by unanimous vote the following resolution and statement prepared by the Board of Direction.

"Whereas, the director, formerly chief engineer, of the U. S. Reclamation Service, has recently been summarily dismissed by the Secretary of the Interior, apparently without a hearing, after a connection with this Service since its organization over twenty years ago—this Service being a Bureau charged with the construction and operation of engineering works, and

"Whereas, this summary dismissal of the head of a technical bureau, apparently without a hearing, may be made the precedent for other similar removals when prompted by political expediency; and because the engineering profession is deeply concerned in the wise and efficient direction of public works,

"Resolved, That the Board of Direction of the American Society of Civil Engineers approves the action of its executive committee in appointing a special committee to collect additional facts and report further upon this matter."

The Board submitted for the information of the annual convention the following statement:

"The Reclamation Service has had an honorable and a creditable career of over twenty years. Its conduct during that period has been under the constant surveillance of the officers of the national administration, of members of congress and of the residents of the numerous communities in which the projects have been constructed.

"The nature of its operations is such as to arouse the watchful care of those who are to be served and the active opposition of those whose interests might run counter.

Scandals Lacking

"Throughout this long period there has been no scandal and no sustained charge of lack of faithful loyalty to public interests. The works erected and the precedents established serve as worthy examples for our own country and have been used as a guide in such developments in other lands. The personnel of the Service has been remarkably loyal, conscientious and devoted to a high standard of public service. The dismissed director has been either chief engineer or director since the establishment of the work in 1902, and was at least entitled to a written statement of reasons for dismissal as provided in civil service regulations, and as required in proper administrative practice.

"The reported reason of better business administration advanced for the replacement of the Director by a successor under the new title of Commissioner, appears to be a pretext which is refuted by the long and honorable business record of the Director dismissed, in comparison with such record as we can obtain of the appointee selected to succeed him. The implication that engineers are not competent business administrators is refuted by numerous engineers who today are conducting as executives, many of the great railroad systems, public utilities and industrial enterprises of this and other countries, and the U. S. Reclamation Service is peculiarly an engineering enterprise.

"The Board fears that any pretext of better administration could only be regarded as a perversion of the proper precepts of a rightful economy to suit the needs of an ever present political situation.

"The Board deplores the action taken by the Secretary of the Interior, for the following reasons:

1. That it will work irreparable injury to the public service in the breakdown of morale and confidence of public employees.
2. That it is an injustice to a man who has given forty-one years of faithful and valuable service to the Government of the United States.
3. That arbitrary methods of removal are not creditable to a popular government based upon equality and fair dealing.
4. That the change now inaugurated bears evidence of an attack upon a worthy and highly creditable branch of the government service to serve political needs.
5. That the conversion of the Reclamation Service into a political machine would result in the withdrawal of public confidence and national financial support with the resultant injurious effect upon the development of the West."

Alabama Power Co. to Build 132,000-Hp. Plant

The new hydro-electric development which the Alabama Power Co. has announced it will build at Cherokee Bluffs on the Tallapoosa River at a cost of about $10,000,000 will, with the exception of the Muscle Shoals development, be the largest hydro-electric plant in the South. Its ultimate capacity will be 132,000 hp. The initial installation will be two 44,000-hp. units. A dam 800 ft. long, 120 ft. high, and containing 200,000 cu.yd. of concrete will form a reservoir covering 22,500 acres and holding about 25,000,000,000 cu.ft. of water.

Twenty-five miles of railroad are to be built to give access to the site.

New York Has New Transit Bureau

As a check on the state-controlled Transit Commission the Board of Estimate of New York City has appointed a transit bureau consisting of the dock commissioner as chairman, the president of the Board of Aldermen and the chief engineer of the Board of Estimate.

The new bureau is to handle all negotiations between the city and the Transit Commission.

Robert W. Hunt Dead

Robert Woolston Hunt, head and founder of the nationally known inspection firm bearing his name, died July 11, just one day after the Board of Direction of the American Society of Civil Engineers had made him an honorary member of the Society. Captain Hunt was born Dec. 9, 1838, in Fallsington, Pa., and spent several years learning the practical side of iron making in the rolling mills of John Burnish & Co., Pottsville, Pa. Later he took a course in analytical chemistry in the laboratory of Booth, Garret & Blair, upon the completion of which he entered the employ of the Cambria Iron Co., Johnstown, Pa., and for them in 1860, established the first laboratory in America as a direct part of an iron or steel organization.

In 1861 he entered the U. S. Military Service and was in command of Camp Curtain at Harrisburg, Pa., with the rank of captain. Upon being mustered out of service he returned to the employ of the Cambria Iron Co. at Wyandotte, Mich., where experiments with the new Bessemer process of making steel were being conducted. He was in charge of the experimental works in 1865, and so continued for a year, when the Cambria Company called him back to Johnstown to take charge of their steel business. It was at this mill later, and largely under Mr. Hunt's direction, that the first commercial order for steel rails ever made in America was rolled.

With Bessemer Works

Later he assisted in designing and building the Bessemer works at the Cambria plant, and in 1873 moved to Troy, N. Y., becoming superintendent of the Bessemer works of John A. Griswold & Co. and in 1875 he became general superintendent of the Albany & Rensselaer Iron & Steel Co. During those years of active connection with steel rail manufacture, he almost completely rebuilt the various works of this company, and also patented many details of iron and steel metallurgical processes and machinery, including, in conjunction with others, the first automatic rail mill tables.

In 1888 he removed to Chicago and established the bureau of inspection, tests and consultation, now known as the Robert W. Hunt Co.

Mr. Hunt was twice president of the American Institute of Mining and Metallurgical Engineers; past president of the American Society of Mechanical Engineers; past president of the American Society for Testing Materials and past president of the Western Society of Engineers. He was also a member of various other technical societies both in this country and Europe.

In 1912 he was awarded the John Fritz Medal (for his contributions to the early development of the Bessemer process) and in June of this year he was given the Washington Award of the Western Society of Engineers in recognition of his achievement. He was for many years a trustee of the Rensselear Polytechnic Institute, and in 1916 received from it the honorary degree of Doctor of Engineering.

Turner Reports on New York Suburban Traffic

Some important features of the suburban traffic problem of New York City and environs are dealt with in the preliminary report on the Metropolitan Transit Plan submitted to the New York City Transit Commission by D. L. Turner, the consulting engineer of that commission. Mr. Turner's study is still in its early stages and no attempt has been made to answer any of the pressing questions of the suburban traffic problem. Some general conclusions are, however, considered practical at this time and are therefore included in his preliminary statement.

The report outlines the area covered in the study, roughly the parts of New York, New Jersey, and Connecticut within a 50-mile radius of the City Hall, estimates its future population, and gives a summary of the present traffic flowing into New York, and a review of the conditions surrounding the passenger service as regards the number of trains per hour during rush hours and the requirements for handling these trains if they were operated in subways in Manhattan.

The report closes with a statement of the following general conclusions: (1) that ten years hence it will be impossible to accommodate the 600,000,000 or more suburban passengers per year with the facilities that now exist; (2) that it will be impossible to take care of this traffic on the city transit lines, for it will be as much as the city can do to obtain facilities for the traffic originating within its limits; (3) that it will be impossible to inject the suburban traffic into the city transit lines by extending them into the territory now served in part by these suburban lines, for under such conditions the trains would be filled to capacity before they reached the city limits; (4) that in order to accommodate this suburban business it will be necessary either to provide additional terminals for accommodating it or to shunt it all past the existing terminals and provide separate and independent collecting and distributing systems traversing central Manhattan, for the exclusive use of the suburbanites now served by the steam railroads; (5) that the second of the two alternatives mentioned above is the proper basis on which to develop the metropolitan transit plan, while adoption of the first alternative would only tend to increase the congestion on the city transit lines, thereby throttling those facilities.

Public Works and Highway Bodies Separated in California

The California Highway Commission was divorced from the Department of Public Works and the state engineer was made head of the latter department by a bill passed by the recent California legislature and immediately signed by the Governor. This action restores the departments involved to independent operation as they were before the passage of the law in 1921 that combined all engineering functions of the state under the Public Works Department and made the state highway engineer head of that department. A report of the combination appeared in *Engineering News-Record* July 28, 1921, p. 167.

Engineering News of the Railroads

Capital Expenditures of the Pennsylvania system for enlargements and improvements in 1922 were restricted to immediate operating necessities, but these expenditures on roadway and structures amounted to $5,272,483. The annual report states that "much larger expenditures must be made in 1923." The improvements include line revision from Lemoyne to Shippensburg, Pa.; rearrangement of terminal facilities and track elevation at Pittsburgh; classification yard at Sharpsburg; delivery yard at Kearney, N. J.; elimination of grade crossings at Cornwells; shop and engine terminal facilities at Enola, Altoona, Pitcairn and Hagerstown; pier, grain elevator and freight yard at Baltimore; second track and revision of line and grade on Cleveland & Pittsburgh line; construction of low-grade line from Kenwood to Rochester, and track elevation at Indianapolis, Ind.

Completion of Negotiations as to the disposal of the Morris Canal is noted in the annual report of the Lehigh Valley R.R. In March, 1923, the railroad company transferred to the State of New Jersey the ownership of the Morris Canal & Banking Co. and cancelled its lease of the canal property made in 1871. The agreement with the State permanently established the railway company's title to the "Big Basin" property in Jersey City, on the Hudson River, an important terminal site upon which are piers and other facilities. In addition the company retains the canal right of way through Jersey City and Bayonne, reaching a growing industrial section, and part of the canal right of way at Phillipsburg; but it is relieved of taxes and maintenance of canal property for which it had no use. This means a saving of approximately $300,000 annually. To secure these favorable terms the company relinquished the balance of the canal right of way, the "Little Basin" on the Hudson River, the water rights of the canal company, and agreed to pay the State $875,000 in five annual installments.

The Chicago, Indianapolis & Louisville Ry. started work on its track elevation at Indianapolis last year and will continue it during 1923. This will necessitate the construction of a new freighthouse, with team facilities at the street level and tracks and platforms on the upper floor.

The Buffalo, Rochester & Pittsburgh Ry. in 1922 reinstated its policy of general improvement, which had been in abeyance for some years, and will continue the work through the present year. This work includes strengthening steel bridges, replacing timber bridges and trestles with permanent structures and improving the track with heavier rails and stone ballast. The improvements carried out in 1922 included $170,000 for sidings and yards extensions, $26,500 for bridges, $135,280 for rails and ballast, $53,237 for a coal handling plant at Rikers, Pa., $44,340 for shop machinery and tools and $15,014 for the Brown St. subway at Rochester.

The Delaware, Lackawanna & Western R.R. annual report states that a reduced expenditure for additions and betterments in 1922 is "due to the fact that previous liberal expenditures of this character were for construction of such a permanent value that it was not found necessary to make as great expenditures for these purposes as were required in preceding years."

Improvement Work Now in Progress on the Louisville & Nashville R.R. and expected to be completed in 1924 includes 15.48 miles of second track between Hazard and Lennut, Ky. (with three tunnels paralleling existing tunnels); second track and reduction of grade from Bailey's to Wallsend, Ky., 16.63 miles; and new bridge over the Great Rigolets Pass on the Gulf Coast. New yard facilities at Ravenna, Ky., are expected to be completed in 1923.

The Chicago, Rock Island & Pacific Ry.'s most important item of new work is the double-tracking between Topeka and Herington, 70 miles, about half of which will be completed in 1923. A large capital expenditure will be required by the decision to use oil fuel in Arkansas and Louisiana, but it is stated that the saving in cost of oil as compared with coal will make this a productive expenditure. Studies are being made to convert other divisions to the use of oil. Additions and betterments in 1922 totaled $2,590,533 for road and $10,764,747 for equipment.

The Texas & Pacific Ry. Is Carrying out a program of strengthening embankments and 811 miles were widened to standard width during 1922. Stretches of line were raised and waterways increased 50 per cent on account of floods in the Trinity River valley, while owing to the floods in the lower Mississippi valley during May and June, 1922, a large part of the maintenance forces were engaged in raising and strengthening the levees.

The Chicago Great Western Ry. Reports that it will ultimately acquire the Mason City & Fort Dodge R.R., having made a settlement with the bondholders. The Chicago Great Western Ry. can now go forward with many capital improvements which are needed by the Fort Dodge line but for which there was no provision in the former lease.

Preliminary Work For a New double-track bridge over the Mississippi River, to replace the present bridge at Fort Madison, Iowa, is noted in the annual report of the Atchison, Topeka & Santa Fe Ry. The cost is estimated at $4,000,000. The report states that this new double-track bridge "is imperatively required by the density of the traffic over the Chicago-Kansas City line and the heavy power necessary to haul it economically." Soundings and preliminary studies for the location of the bridge are now under way.

The Kansas City Southern Ry. Co. Has Been Denied permission to abandon 1.5 miles of its railway into Independence, Mo.

A Steel Side-Wheel Car Transfer Steamer is being built for the New Orleans, Texas & Mexico Ry. for transferring cars across the Mississippi River at Baton Rouge, La. This vessel is 340 ft. long and 91½ ft. wide over the guards, with three tracks, giving a capacity of eleven large passenger cars or twenty freight cars. The steamer, which is to be put in service this summer, was built by the Dravo Contracting Co., Pittsburgh, Pa., at a cost of about $255,000.

The Baltimore & Ohio Has Applied to the I.C.C. for authority to abandon 9.3 miles of the Bedford, Md., Branch, claiming that the traffic does not justify the heavy maintenance charges, and for authority to sell 1.5 miles of its line in Bedford to the C. I. & L. Ry. Co.

The Oregon Short Line R.R. Co. Has Applied to the I.C.C. for authority to construct a railroad from Rogerson, Twin Falls County, Idaho, to Wells, Elko County, Nevada, a distance of 98 miles, in order to provide an additional outlet to the highly developed irrigated districts of Southern Idaho.

Authority Has Been Granted to the Southern Pacific R.R. by the I.C.C. to construct a branch line in Kern County, Calif., from Magunden to a point near Arvin, a distance of 17.64 miles. Construction is to begin before July 1, 1923 and be completed by Dec. 31, 1923.

The First Electrically-Operated Train on the Chilean State Railways recently made a successful trip from Santiago to Tiltil and return, a distance of 24 miles. President Alessandri of Chile was at the controller and the American ambassador was a passenger on the train. The order for the equipment for this railway was placed with the Westinghouse Electric & Mfg. Co. in 1921. The total mileage to be electrified is 144.

The Norfolk & Western Ry. lists 130-lb. rails on 115 miles of track and 100-lb. rails on 1,516 miles, of which 70.5 and 221.4 miles were laid in 1922.

Creosoted Ties and 136-lb. Rails are noted in the annual report of the Lehigh Valley R.R. Continued use of treated ties has reduced materially the number of annual renewals, and only 245,848 ties had to be placed during 1922. At the end of the year the railway had 5,953,827 creosoted ties, or more than 64 per cent of the total number, while 415 miles of track were laid with 136-lb. rails.

Valuation on the Erie R.R. Is Practically completed and the annual report of the company states that the Bureau of Valuation, Interstate Commerce Commission, has finished for informal review the engineering reports of physical improvements. These reports are being reviewed. Land reports upon the entire system were expected within a few months. The field work was practically finished by the end of 1922 and the entire work about 85 per cent completed. The cost of Federal valuation at the end of 1922 was $1,143,492, of which $745,487 was charged to operating expenses, the remaining $398,005 having been assumed by the U. S. Railroad Administration during the period of Federal control.

A Reduction of 102 Miles in the distance between Toronto and Winnipeg by the Canadian National Railways is being effected by the construction of the 29½-mile Long Lake cut-off, north of Lake Superior, connecting the two main lines of the former Canadian Northern Ry. and National Transcontinental Ry. The contract for grading, bridges and culverts was let in December, and work is reported as progressing favorably. The new line has economic advantages in addition to reducing the mileage.

Random Lines

Thanks for the Ad

Simeon Strunsky, the genial and erudite editor of the New York *Evening Post*, has been traveling into New York over the Long Island Ry. and after the custom of all good editors he has been looking out of the car windows for copy. In consequence, the engineer is indebted to him for the following appreciation:

The deluded archæologist will write the history of America from the ruins of the Woolworth Tower and the history of Forest Hills from the pink concrete arches of that over-powering railroad station. No one ever excavates market gardens or wheat fields or olive groves. The engineer and the mason hold a corner on history.

The engineer, the mason and the concrete mixer deserve the posthumous credit they are in for, and especially the engineer. He is about the only man who can lift himself by his bootstraps; that is to say, he is the only man who can keep traffic going along an old railroad while he is building a new one. In the region of trans-Jamaica the engineer and the contractor are now engaged in laying new trackage, elevating and depressing roadbeds, throwing lines of shining new railway ties across the ruins of promising park "developments"—and all the time managing to get commuters all into Pennsylvania Terminal and back to their homes almost on schedule; almost, though not quite. The engineer runs his trains over apparently precarious sand piles and around the most casual corners, and the switches grind, and the train halts here and spurts there, and outside the window low-grade Mediterraneans and Alpines in sweat-soaked undershirts dig, and shovel, and heave, and drag, and you get home almost in time—almost, though not quite—and some day there will be a fine new four-track railroad built under your flying wheels.

Perhaps that is what people mean when they want the engineers to tackle the job of world reconstruction. If anybody can somehow manage to keep the old world going while building a new one under its feet it ought to be the engineers.

* * *

A French scientist, returning home from a visit to New York, says that stray electric currents there are undoubtedly affecting the nerve and brain capacity of New Yorkers. There are plenty of Americans who will admit that New Yorkers have nerve, but brains—well, the French were always a polite people.

* * *

The Discussion Was Limited

Everyone who was at Chicago last week seems to agree that the American Society of Civil Engineers' meeting there was a success. And yet—the technical discussion consisted of the presentation of six papers in 2½ hours and ten papers in 3 hours. According to one member, the audience only opened its mouth to yawn.

City of Baltimore Reorganizes Highways Department

The Highways Department of the City of Baltimore has been reorganized under the direction of Bernard L. Crozier, recently appointed highways engineer. Eighteen positions have been abolished and two created, meaning a reduction of $26,100 in salaries annually. The post of assistant highways engineer, with a salary of $3,800, is created. It will combine the work of the bridge engineer, department engineer and division engineer of highways. J. Wilson Richardson, bridge engineer, has been appointed to the position. Steuart Purcell, recently appointed chief engineer of Baltimore, formerly filled the position of division engineer of highways. Thomas J. O'Connell was department engineer.

Highway Engineering Fellowships Offered by Michigan

The University of Michigan Graduate School offers again this year according to an announcement by Arthur H. Blanchard, professor of highway engineering and highway transport, the following fellowships: Roy D. Chapin Fellowship in High Transport, Roy D. Chapin Fellowship in Highway Engineering, and Detroit Edison Fellowships in Highway Engineering. Of these, two will be awarded not later than Sept. 10 and two not later than Nov. 1, to holders of Bachelor's degrees from college or university. Each Fellowship carries an allowance of $300 with no tuition to pay, and leads to the degree of Master of Science or Master of Science in Engineering.

Main Reservoir on Hetch Hetchy Project Fills in Three Weeks

THE siphon spillways in O'Shaughnessy Dam on San Francisco's Hetch Hetchy water supply project began to spill on May 25, three weeks after closure of the valves in the dam. The eighteen siphon spillways each have a capacity of 1,000 sec.-ft. and are built with a 3-in. difference between the throat levels of successive siphons. Thus the capacity of the spillway as a whole will increase as the reservoir level rises. The crest of the dam is at El. 3726½ and the present reservoir level is at El. 3721, at which height the reservoir capacity is 65,000,000,000 gal.

New Phase of Work on Plan for New York and Environs

By Oct. 1 the Committee on the Plan of New York and Its Environs expects to have completed its various preliminary surveys and to begin active planning work. Thomas Adams, the British town planning expert, who has been chairman of the Advisory Planning Group of the committee since Jan. 1, will become general director of plans and surveys on Oct. 1, when Frederic P. Keppel, who has been acting as executive secretary, will retire to become president of the Carnegie Corporation. Frederic A. Delano, formerly president of the Wabash R.R., has already succeeded Charles D. Norton, deceased, as chairman of the committee. Nelson P. Lewis, formerly chief engineer of the New York City Board of Estimate, and other staff members, will continue with the committee.

Rail Committee Against Outside Control of New England Roads

On railroad consolidation as it affects New England the Joint New England Railroad Committee has presented a report to the governors of the six states which is adverse to any consolidation which will turn the railroads of that section over to one of the large trunk lines having its principal interests outside of New England. The committee suggests that New England should run its own roads and with this idea in view it proposes a rehabilitation of the Boston & Maine and the New Haven, state help by the remission of taxes and a guarantee of certain charges, federal aid by a reduction of interest rates, and a sort of trusteeship by men appointed in quotas by the several states. If consolidation with a trunk road is made necessary by legislation or other conditions then the committee recommends that the consolidation be made with the Pennsylvania system.

Colorado River Action May Follow Flaming Gorge Permit Issuance

By granting a preliminary permit to the Utah Power and Light Co. covering its Flaming Gorge project on Green River, the Federal Power Commission has inserted the thin edge of the wedge which is expected to lead to action on the Colorado River projects. Regardless of what Arizona may do with regard to the ratification of the Colorado River compact, it is believed that the Commission will award this fall the Girand license, covering the large development proposed at Diamond Creek. It is believed also that the upstream states could not insist successfully that the Arizona project be held up when they have urged the granting of the Flaming Gorge permit. Prominent officials of both Utah and Colorado now are urging the granting of that permit.

The load of the Utah Power and Light Co. has been increasing at such a rate that a steam auxiliary must be put into operation in the near future. Unless the Flaming Gorge development is allowed to proceed as rapidly as possible, it will be necessary to construct additional steam units. It is to avoid this latter situation that so much pressure has been brought to permit the company to proceed with its foundation explorations at Flaming Gorge.

Engineering Societies

Calendar

Annual Meetings

NEW ENGLAND WATER WORKS ASSOCIATION, Boston, Mass.; Annual Convention, Burlington, Vt., Sept. 18-21, 1923.

AMERICAN PUBLIC HEALTH ASSOCIATION, New York; Annual Meeting, Boston, Oct. 8-11.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York; Fall Meeting, Richmond, Va., Oct. 15-17.

AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS, St. Petersburg, Fla.; Annual Convention, Atlanta, Ga.; Nov. 12 to 16.

The American Society of Agricultural Engineers will hold its annual meeting in Chicago Nov. 8-10. Principle discussions will include farm power and equipment and farm structures, rural electrification and reclamation, and the problems of teaching and extension and research work. The society's secretary is Richard Olney, St. Joseph, Mich.

The Engineers Club of Baltimore has elected the following officers: president, Earl Stimson; first vice-president, Henry G. Perring; second vice-president, G. J. Requardt, and treasurer, Robert B. Rifenberick.

Personal Notes

F. H. ROOD has been appointed engineer of tests of the Pittsburgh, Pa., Testing Laboratory, with headquarters in Pittsburgh. Mr. Rood is a civil engineer graduate of Syracuse University. For many years he was engineer of tests of the New York state highway commission, for three years he was assistant engineer of tests of the Pittsburgh Testing Laboratory, and for two years a research engineer with the U. S. Bureau of Public Roads.

C. W. CREEKBAUM, recently appointed project engineer on construction for the Florida State Road Department, was formerly county highway engineer of Scioto County, Ohio, and prior to that was assistant city engineer of Portsmouth, Ohio.

A. MCGILLIVRAY, highway commissioner of Manitoba, was elected chairman of the Manitoba branch of the Canadian Institute of Engineers, at the recent annual meeting of the organization.

CARL T. POMEROY, of Melrose Highlands, Mass., for the past nine years health inspector for the North Shore District of the Massachusetts Department of Labor and Industries, became health officer of Montclair, N. J., on July 1, succeeding H. B. Larner, whose services ended Dec. 31 last. Mr. Pomeroy received a C.P.H. from the School of Public Health of Harvard and the M.I.T. a year ago. He was graduated from Bates College with the degree of A.B. in 1909 and soon afterwards was assistant health officer and bacteriologist at Plainfield, N. J., and then held a similar position at Summit, N. J., each for a short time.

JAMES L. TIGHE, Holyoke, Mass., who for twelve years served as city engineer of Holyoke and since then has been in private practice as a consulting engineer, has been appointed a member of the Public Health Council of the state of Massachusetts.

LEE POWELL, recently of Harris & Powell, highway contractors, has been appointed city engineer of Tyler, Tex., succeeding Sam H. Bothwell, who resigned to become city manager of Longview, Tex. Mr. Powell is a graduate of the engineering college of the University of Texas.

WILLIAM EISENBERG, general contractor, Woodbine and Vineland, N. J., announces the removal of his Vineland office to Camden, N. J.

JOHN DUBUIS and C. M. REDFIELD announce the opening of an office in Bend, Oregon, under the firm name, Dubuis & Redfield, consulting engineers, and will give special attention to irrigation, drainage, water supply, sewerage and hydro-electric work.

ROBERT MCCONNELLY, of Fort Wayne, Ind., has been appointed city engineer of Appleton, Wis., succeeding O. F. Weissgerber, resigned.

P. J. FREEMAN, formerly engineer of tests with the Pittsburgh Testing Laboratory, announces the opening of offices for general consulting engineering at 311 Ross St., Pittsburgh, Pa. He has already been retained by the Standard Inspection Co. to supervise their testing of materials.

DAVID L. STRUTHERS, who has been highway engineer for Gaston County, N. C., with headquarters at Gastonia, has resigned and has been appointed city manager of Gastonia, N. C.

CLEVELAND B. COE has been elected commissioner of public works of Johnson City, Tenn. He is a graduate of Hobart College, was a student at Carnegie Institute of Technology, served as lieutenant of field artillery with the 32nd Division, and since the war has been in private practice in Johnson City.

J. R. ELLIS, assistant chief engineer for the Utah State Road Commission, has resigned to become assistant engineer of the Union Pacific R.R. on construction of the 7-mile line from Park City to the Park-Utah mine.

M. M. LEIGHTON has been appointed chief of the Illinois State Geological Survey, with office at Urbana, Ill., succeeding F. W. DeWolf who resigned recently.

PAUL HAMILTON, engineer of track and roadway on the Cleveland, Cincinnati, Chicago & St. Louis Ry., has been appointed assistant chief engineer, with office at Cincinnati, Ohio, to succeed Hadley Baldwin, who has been promoted.

L. D. SNYDER, civil engineer, who has been a superintendent of construction and specialist in concrete roads and bridges for the George T. Wilhelm Co., contracting engineers, Cedar Rapids, Iowa, has been made general superintendent of construction. He was formerly county engineer at Humboldt, Iowa.

F. E. WEYMOUTH has been appointed a member of the committee to report on the Columbia Basin and Umatilla Irrigation Projects for the U. S. Reclamation Service. The committee now consists of Francis M. Goodwin, Assistant Secretary of the Interior; David W. Davis, Commissioner of Reclamation; and Mr. Weymouth.

ERIC FLEMING, until recently assistant city engineer of New Brunswick, N. J., under Asher Atkinson, city engineer, has resigned to join the architectural and structural division of the Electric Bond and Share Co., New York City.

PAUL C. GISIGER, formerly designer for the Southern Power Co., has accepted a similar position with the Fargo Engineering Co., Fargo, N. D.

C. L. CRANDALL has been appointed assistant engineer in charge of surveys for the New York and New Jersey Bridge and Tunnel Commissioners in work on the vehicular tunnel, having served in similar capacity with the Transit Commission of New York City.

ROSS W. TAYLOR has changed from field engineer with A. W. Kutsche & Co., Detroit, Mich., to a similar position with the Otis Steel Co., Cleveland, Ohio.

H. R. SMITH, formerly mayor and city engineer of Belton, Texas, has been made county engineer of Wise County, Texas.

H. D. ROBINSON and D. B. STEINMAN, consulting engineers, have been retained by the West Penn Railways Co. to make an investigation of the suspension bridge across the Ohio River at Steubenville, Ohio, of which a stiffening truss failed under a heavy load as reported in *Engineering News-Record* on May 31. Robinson and Steinman are engaged in making an inspection, re-calculation, re-adjustment, and strengthening of the structure for the increased loads it has to carry.

Obituary

SIDNEY B. CADY, Bloomfield, N. J., for thirty years an assistant engineer in the Bureau of Highways, New York City, and later town engineer of Bloomfield, died July 13 at the age of 70. He was a native of Vermont and a graduate of Middlebury College and of Dartmouth.

CHARLES T. TAYLOR, secretary and treasurer of the William Cramp & Sons Ship and Engine Building Co., Philadelphia, Pa., died in that city recently.

WILLIAM DALY, railway contractor, died in Outremont, Province of Quebec, recently at the age of 74 years. He was born in Newton Upper Falls, Mass., and went to Montreal in 1872. He was engaged on the aqueduct intake enlargement, the Lachine Canal, Wellington Basin, and later served the Canadian Pacific Ry. for several years as superintendent of construction.

JAMES T. MCCARTHY, 33 years old, a civil engineer in the employ of the Baltimore & Ohio R.R., died on July 7 at his home in Baltimore. During the war he served as a lieutenant in the Second Engineers.

From the Manufacturer's Point of View

A Point of Contact
Between Maker and User of
Construction Equipment and Materials

Additional Mixer Standards Approved by Committee

Many Details Simplified as Result of Conference Between Makers and Users

FOURTEEN provisions for the standardization of concrete mixers were approved by the Joint Committee on Construction Equipment in session with members of the Associated General Contractors and representatives of mixer manufacturers at a meeting held in Chicago, June 27-29. These provisions cover a reduction in the number of types manufactured, the furnishing of auxiliary equipment, standard capacities and ratings and many other points of mutual interest to the manufacturer and the user of equipment. In *Engineering News-Record's* report of the meeting, in its issue of July 5, p. 36, details of about half of the approved measures were given; the remaining points are covered in the paragraphs below:

The recommendations of the Joint Committee, which now go to the Associated General Contractors for approval, deal only with the horizontal non-tilting drum type of mixer. It was recognized that the work of standardizing tilting mixers involved problems peculiar to these types which could only be determined after full consideration of the various points in conjunction with the manufacturers of tilting machines. Another meeting of the Joint Committee is scheduled for this week.

Standards to be A.G.C.

Upon recommendation of the manufacturers present at the Chicago meeting it was agreed that the standards adopted should be designated as A.G.C. Standards pending the establishment of contact with the American Engineering Standards Committee and the adoption of American standards. At the request of manufacturers, also, the Joint Committee approved the use of a standard name-plate to be later designed by manufacturers, giving the standard rating of the machine and its capacity for various proportions of mix, with a statement that the machine conforms with standard A.G.C. requirements. As a means of securing general adoption of the recommended standards the manufacturers requested that the right to use the name-plate be obtained from the Associated General Contractors and that the name-plate be purchased through the Joint Committee on Construction Equipment from a company to be designated later.

Portions of the committee's approved report not covered in the issue of this journal referred to in the opening paragraph follow:

For the three standard sizes of paving mixer approved the Joint Committee has prepared Table I, showing the number of sacks of cement per batch.

For three of the four standard sizes of building mixer, Table II shows the sacks of cement per batch.

Building Mixers

(a) Extension power loaders shall be eliminated.

(b) Mixers shall be equipped with tanks of sufficient size to deliver the indicated quantities of water per batch as follows: 7-S, 12 gal.; 14-S, 22 gal.; 21-S, 32 gal.; 28-S, 42 gal.; 7-E, 12 gal.; 12-E, 22 gal.; 21-E, 32 gal. Tanks shall withstand a working pressure of 150 lb. per square inch. One tank shall be standard.

Water supply connections shall be furnished as follows: 7-S, ¾-in. garden hose nipple; 14-S, 1¼-in. standard iron pipe connection; 28-S, 2-in. standard iron pipe connection; 7-E, 1¼-in.; and 12-E and 21-E, 2-in. standard iron pipe connection.

TABLE I—PAVING MIXERS

Mix	Number of Sacks in Batch — 7-E	12-E	21-E
1–1¼–3	2	3	6
1–1½–3½	2	3	6
1–2–3	2	3	6
1–2–3½	1	3	5
1–2–4	1	3	5
1–2½–5	1	2	4
1–3–6	1	2	3

TABLE II—BUILDING MIXERS

Mix	Number of Sacks in Batch — 7-S	14-S	28-S
1–2–4	1	3	6
1–3–6	1	2	4

(c) Discharge control on one side only shall be standard, but may be furnished on both sides as an extra.

(d) Skips shall be made with closed ends.

(e) Standardization of wheels shall be referred to the Concrete Mixer Association for further investigation and report.

(f) Power discharge shall be eliminated as standard but the manufacturers may furnish same on 28-S and 56-S mixers as an extra.

Paving Mixers

(a) Only full caterpillar tread or four wheels shall be used on 12-E and 21-E machines, and four wheels only on 7-E machines.

(b) Maximum width of skip 4 ft. from end shall be 100 in.

(c) Power steering control shall be used in full caterpillar and hand steering on four-wheel machines.

(d) Hand power boom swing only shall be used.

(e) Maximum speed of travel of mixer shall be 1½ miles per hour and minimum ½ mile per hour.

(f) The batch transfer derrick shall have a reach of 14 ft. from center line of machine as standard.

(g) Engine tools only shall be furnished on the 7-S mixer. On the 14-S, the 21-S, the 28-S, and on all paving mixers the manufacturer shall furnish all necessary special tools and a kit of standard tools to be agreed upon by the Manufacturers' Committee.

(h) An auxiliary hoisting drum may be furnished only on the 7-S as special equipment.

Miscellaneous Recommendations

Shafts and Gearing — The sizes of shafts, keys, keyways, gears, and the composition of gears shall be referred to the American Society of Mechanical Engineers for recommendation as to procedure in standardization.

Standardization of Power—The question of standardization of power with reference to requirements for different machines shall be referred to the A.S.M.E. for advice as to proper procedure.

Safety Devices—All working parts shall be guarded in accordance with the requirements of state laws. Paving mixers shall be provided with safety devices to protect men when the skip is being lowered.

Standardization of Names of Parts —The nomenclature of the Concrete Mixer Association, with additions recommended by the Manufacturers' Committee above named, to bring this nomenclature up to date, shall be adopted as standard.

Name Plate—A name plate giving the standard rating of the machine, its capacity for different portions of mix and such other data as may be later determined, shall be affixed to each machine. A committee of three manufacturers shall pass upon the plate and manufacturers shall obtain the right to use this plate from the A.G.C. It is recommended that pending adoption of American Standards, the plate state that the machine meets the standard A.G.C. requirements as approved by the Joint Committee of manufacturers and contractors.

Lubrication, Bearings and Anti-Rust Paint—The manufacturers shall fully, effectively and honestly set forth in their printed matter, information on the principles of lubrication, care and composition of bearings and material and the use of anti-rust paint as used in their machines.

Composition of Committee

The Joint Committee on Construction Equipment is headed by C. E. Bement, chairman, Novo Engine Co., Lansing Mich., and includes the following members representing manufacturers:

H. B. Bushnell, Western Wheeled Scraper Co., Aurora, Ill.; Phillip Koehring, Koehring Co., Milwaukee; F. H. King, Marion Steam Shovel Co., Marion, Ohio; H. H. Baker, Sterling Wheelbarrow Co., Milwaukee; H. W. Howard, General Motors Truck Co., Pontiac, Mich.; C. D. MacArthur, Blaw-Knox Co., Pittsburgh, Pa.

Representatives of the users of equipment on the committee are:

H. V. Coes, American Society of Mechanical Engineers; Stanley D. Moore, Moore-Young Construction Co., Waterloo, Iowa; W. A. Rogers, Bates & Rogers Construction Co., Chicago; A. P. Greensfelder, Fruin-Colnon Contracting Co., St. Louis, Mo.; W. D. Hill, Samuel Gamble Co., Carnegie, Pa.; Frederick L. Cranford, Frederick L. Cranford Co., Brooklyn, N. Y.; W. A. Walbridge, Walbridge-Aldinger Co., Detroit; Frederick Ward, Ward & Tully, Brooklyn, N. Y.; R. C. Marshall, Jr., Associated General Contractors, Washington, D. C.; Ward P. Christie, secretary, 1038 Munsey Building, Washington, D. C.

Reduce Brick Varieties to Two Standard Sizes

Washington Correspondence

One standard size for common brick and one for face brick were adopted formally at a general conference of manufacturers, distributors and representatives of large consumers held at the Division of Simplified Practices of the Department of Commerce, Washington, D. C., June 21.

The size determined upon for common brick and textured face brick was 8 x 2¼ x 3¾ in.; that determined upon for smooth face brick was 8 x 2¼ x 3⅞ in. Tolerances and variations in size due to shrinkage while being burned, different clays and other factors, will be allowed, the permissible tolerances to be studied by the American Society for Testing Materials in connection with the American Face Brick Association and the Common Brick Manufacturers Association of America. The final report of these organizations will assist in deciding the standard tolerance and variation which will apply to the approximate standards.

By adopting these two standard sizes, the conference eliminated at least 38 rough brick and 35 smooth brick varieties. A survey of 167 plants producing rough brick and of 141 plants producing smooth brick in 1922 showed that from 80 to 90 per cent of the total output conforms to the standard sizes adopted by the conference. The final conference followed a preliminary meeting held May 11, where elimination of excess sizes was discussed.

Motor Vehicle Production

Production of motor vehicles during May, based on figures received by the Bureau of the Census in co-operation with the National Automobile Chamber of Commerce and covering approximately 90 passenger-car and 80 truck manufacturers each month, are shown in the accompanying table. It will be noted that the May figures for trucks are almost double those for the same month last year.

AUTOMOBILE PRODUCTION
(Number of Machines)

	Passenger Cars		Trucks	
	1923	1922	1923	1922
Jan.....	223,706	81,693	19,398	9,416
Feb.....	254,650	109,171	*21,817	13,195
March.....	*319,638	152,959	*34,681	19,761
April.....	*344,474	197,216	*37,527	22,342
May.....	350,180	232,431	42,983	23,788

* Revised.

Use of Mechanical Loaders for Snow Work Increases

An increased use of mechanical loaders of the elevating bucket type for snow removal work in cities is shown by the sales records of the Barber-Greene Co., Aurora, Illinois. To date, cities and street railway companies have purchased exclusively for snow work 22 Barber-Greene loaders. Chicago is the largest user with four machines. Next, with two machines each, are the cities of Philadelphia and Providence, in addition to three street railways, including the Third Ave., New York, the Boston Elevated and the Springfield (Mass.) Street Railway. Owners of one loader include the cities of New York, Pittsburgh, Springfield (Mass.), Albany and Schenectady as well as the street railway companies of Worcester, Mass., Albany and Ottawa, Canada.

Standards Committee Considers C.-I. Gas Pipe Specifications

The American Gas Association has submitted for the approval of the American Engineering Standards Committee three specifications for cast-iron pipe and special castings which, it is said, are in general use for underground gas pipes throughout the United States. The Standards Committee has appointed a large and representative special committee to consider the application for the approval of these specifications, and sponsorship for future revisions under the regular procedure involving the organization of a representative sectional committee to consider and develop any changes required. The following are the members of this special committee and the organizations they represent:

S. G. Flagg, Jr., chairman, American Society of Mechanical Engineers; F. A. Barbour, American Water Works Association; E. A. Barrier, Fire Protection Group on A.E.S.C.; W. Forstall, American Gas Association; A. H. Hall, Gas Group on the A.E.S.C., and American Gas Association; W. G. Hammerstrom, chief engineer, Lynchburg Foundry Co., Lynchburg, Va.; H. Kely Associated General Contractors of America; N. F. S. Russell, U. S. Cast Iron Pipe & Foundry Co.; R. Toensfelt, American Society for Municipal Improvements; W. Wood, president, R. D. Wood & Co.; C. D. Young, American Society for Testing Materials; F. A. McInnes, New England Water Works Association; F. F. Schauer, Natural Gas Association of America; A. W. Claussen, Underwriters' Laboratories; and J. C. Meloon, National Automatic Sprinkler Association.

Sales Managers Organize

The National Association of Sales Managers was organized in Atlantic City, N. J., June 7-8, during the convention of the Associated Advertising Clubs of the World. The officers elected were: President, C. F. Abbott, Pictorial Clubs, Inc., New York; vice-presidents, G. W. Hopkins, Columbia Graphophone Co., New York; L. C. Rockhill, Goodyear Tire & Rubber Co., Akron, Ohio, and Martin J. Wolf, Bussmann Mfg. Co., St. Louis; treasurer, A. E. Pitcher, E. I. duPont de Nemours & Co., Arlington, N. J.

Business Notes

ASHER FIREPROOFING CO. will open Cleveland offices in the B. F. Keith building, July 1, under the immediate charge of Kirby Smith, who recently resigned as a commander in the U. S. Navy to become a member of the executive staff in the Asher company. During his service with the Civil Engineer Corps of the Navy, Commander Smith was engaged largely in concrete construction work. In addition to being a graduate of the U. S. Naval Academy, Commander Smith holds a diploma from the Rensselaer Polytechnic Institute.

INTERNATIONAL CLAY PRODUCTS CO., Philadelphia, manufacturer of vitrified clay conduits, has changed its name to the Clermont Clay Products Co., following a reorganization of the old company.

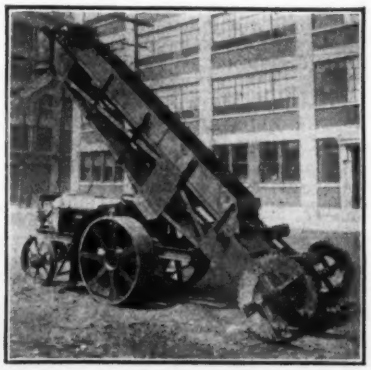
ORTON & STEINBRENNER CO., Chicago, manufacturers of locomotive cranes, dipper shovels and grab buckets announces a reorganization of the company and the election of the following officers: P. A. Orton, president and general manager; E. B. Ayers, vice-president; Herbert Mertz, secretary and sales manager; Harry Shaffer, treasurer and purchasing agent; G. L. Niederst, chief engineer; Alex Orton, works manager. No change in the management, control or policy has been made, nor is any contemplated. The reorganization is occasioned only by the resignation of H. G. Steinbrenner as president and the disposal of his interest in the company.

CONNECTICUT BLOWER CORP., Hartford, Conn., has been incorporated under the laws of Delaware, with capital of $250,000. The officers are: M. E. Keeney, president; C. H. Keeney, treasurer; C. E. Keeney, secretary. The company has taken over the International Blower Co. and the Hartford Sheet Metal Works. The products manufactured and installed include blowers and exhaust fans, blower systems of all kinds, dust-collecting systems, exhaust systems and ventilating systems. The plant of the International Blower Co. will be utilized until fall, at which time a larger plant will be occupied.

Equipment and Materials

Tractor Mounting for Elevating Bucket Loader

A mobile, self-feeding bucket loader mounted on a standard Fordson tractor is the latest product of the N. P. Nelson Iron Works, Brooklyn, N. Y. It is designed for quick moves from one loading point to another, particularly in the case of road contractors who wish to buy only one loader for handling sand, gravel or crushed stone.



Two features of this equipment are emphasized by the manufacturer.

(1) Instead of crawling in under the elevator, where he cannot see what he is doing or digging, and surrounded by chains and sprockets, the operator now stands on a platform at the side of the machine, with all controls in easy reach and with an unobstructed view of the entire digging and loading operation.

(2) By connecting the elevator directly to the engine, instead of to the usual power take-off, the elevator with its toothed digging spiral runs full speed, while the tractor may be inched

backwards into the pile. The spirals level a 6-ft. cut and material once started in motion keeps moving continuously until picked up by the elevator buckets, which are fitted with digging teeth. An overload release gives the operator ample warning of boulders or undiggable material.

The capacity of the machine is 40 yds. per hour of material 2 in. and under that a man can shovel without the use of a pick. A governor is installed to control the fuel consumption to the actual requirements. The power take-off remains available should the owner require its use for operating other machinery, while the entire loader attachment can be readily removed and the tractor used for other purposes. A swivel or turning spout is attached to the loader, permitting discharge sideways into truck. Clearance of 8 ft. 6 in. is given under the discharge chute.

All-Steel Crane Scale Has Capacity of 10,000 Lb.

For use on crane booms in weighing, sorting or grading operations where weights up to 10,000 lb. are handled, the special heavy-duty scale illustrated herewith has been developed by John Chatillon & Sons, New York. In addition to determining the weight of objects handled, the scale is useful in preventing crane overloads and accidents. It is of all-steel construction and its action depends upon four extra heavy, specially tested springs, oil-tempered after coiling. The dial is 15 in. in diameter, clearly etched and easily read. Scales of this type, the manufacturers report, are being used in many industries where overloads on traveling cranes, cables, and other forms of hoisting apparatus might prove disastrous.

Exhibit Shows Durability of Copper and Brass Pipe

The varied uses and durable qualities of copper and brass pipe and fittings were featured in an exhibit by the Copper and Brass Research Association, New York, at the annual meeting last month in Atlantic City, N. J., of the National Association of Master Plumbers. An outline of the history of piping was presented in a panel of oil paintings, starting with the wooden trough and ending with brass pipes. A fragment of copper pipe 5,400 years old, from Egypt, was secured from the museum in Berlin and displayed at Atlantic City. About half a hundred different brass plumbing fixtures were connected up into a "family tree" as shown in the accompanying illustration. Emphasis was given in the exhibit to the rust-resisting qualities of brass pipe and the increased flow of water possible through a clean pipe as compared with a rusted pipe.

Publications from the Construction Industry

Caterpillar Tractors — HOLT MANUFACTURING CO., INC., Peoria, Ill., features its caterpillar tractors in a recently published 40-p. illustrated booklet. The information is largely in the form of pictures illustrating the varied uses of the company's tractors, particularly in road construction and logging. Complete specifications are given for the 10-ton, 5-ton, and 2-ton caterpillar tractors.

Centrifugal Pumps — DE LAVAL STEAM TURBINE CO., Trenton, N. J., has issued a 20-p. illustrated pamphlet on its multi-stage centrifugal pumps. After a brief discussion of the principal parts of the equipment, including casing, impellers, shafts and bearings, the text describes manufacturing methods and materials and the testing of pumps before they leave the factory.

Steel Windows for Schools—TRUSCON STEEL CO., Detroit, in its 28-p. pamphlet "Daylighting Schools," illustrates the uses of a large number of types of its window equipment. Detail drawings and photographs of typical installations are preceded by a treatise on school architecture, with particular reference to windows, by John J. Donovan.

Blueprinting Machinery—C. F. PEASE CO., Chicago, describes and illustrates its new printing machinery and drafting room accessories in a 64-p. illustrated catalog. The apparatus featured includes blueprinting, washing and drying equipment, and high power arc lamps. Several pages are given over to drawing instruments, filing cabinets for tracings and prints, drafting tables and tools.

Business Side of Construction

FACTS AND EVENTS THAT AFFECT COST AND VOLUME

Heavy Freight Traffic Reported by the Railroads

Freight traffic in May was the heaviest for that month in the history of the railroads, according to reports just received from the carriers by the Bureau of Railway Economics, Washington, D. C. It amounted to 39,597,582,000 net ton-miles, an increase of 2.7 per cent over the same month in 1917 when the previous record for that month of the year was made. It also was an increase of 41.7 per cent over May last year, when, however, the miners' strike resulted in a curtailment of coal shipments. Because of this strike last year, freight traffic in May this year in the Eastern district showed an increase of more than 57 per cent over last year, while there was an increase of 24 per cent in the Southern district. The Western district reported an increase of nearly 28 per cent.

Substantial progress is being made by the railroads in carrying out the program adopted by the carriers in April, calling for a speeding up in the movement and the heavier loading of freight cars. The daily average movement per freight car in May was 28.6 miles. Except in May, 1917 when an average of 29 miles was attained, this average has never been excelled in any month before and only once equalled, that one time being in the fall of 1920. The average of 28.6 miles was an increase of 0.6 mile over the average for April.

Every increase of one mile in the average movement of a freight car, it is pointed out, is equivalent to the addition of 100,000 freight cars to the country's transportation facilities.

The program adopted by the railroads calls for a daily average movement per car of 30 miles and for the loading of all freight cars to maximum capacity in an effort to bring the average loading to 30 tons per car for the entire country.

Further Slump in Lumber Movement

The nation's lumber movement for the week ending July 7, as reflected by reports from 392 of the larger commercial mills of the country shows a marked decline from revised reports for the preceding week from 408 mills. Production fell off about one-third, shipments about the same, and orders declined by a sixth, but as compared with this time last year the movement as a whole is substantially larger. The declines in production and shipments are chiefly due to the summer letup and closing of mills for customary semi-annual repairs.

For all the reporting mills shipments were 92 per cent and orders 85 per cent of production; the corresponding figures for Southern Pine mills alone being 93 and 77, and for the West Coast mills 124 and 126. Grouping by themselves the 347 mills with an established normal production, actual production for the week was 74 per cent of normal, and shipments 72 and orders 66 per cent thereof.

The following figures give the summary of the lumber movement for the week ending July 7, the corresponding week of 1922 and the preceding week of 1923:

	Week Ending July 7	Corresponding Week 1922	Preceding Week 1923 (Revised)
Mills	392	366	408
Production, ft.	188,046,983	164,510,776	284,487,287
Shipments, ft.	173,451,837	161,756,252	256,060,910
Orders, ft.	160,497,639	160,665,513	192,972,469

Municipal Bond Sales in June

As a result of the sale of two very large state bond issues the aggregate of state and municipal bonds placed during June, according to the monthly review of the *Commercial and Financial Chronicle*, New York, was swelled to the figure of $156,366,800, the largest total reached in any month of June, always notable for bond disposals of exceptional extent.

Fewer municipalities issued obligations last month than in June, 1922. The large major bond issues last month were for payment of bonuses to war veterans—$25,000,000 in Kansas and $22,000,000 in Iowa. Nevertheless, the aggregate of state and municipal bonds that have come on the market during the first six months of 1923 falls considerably short of that for the first half year of 1922, being $571,803,563 as against $655,086,150.

Prominent bond issues during the month for public works or other forms of construction included $6,720,000 5½s. for the Moffat tunnel in Colorado; $5,000,000 4s. for the Chicago Sanitary District; $5,000,000 4½s. for road and bridge work in New Jersey; $2,750,000 for roads and hospital in Hennepin County, Minn.; $2,500,000 for public building construction in St. Louis, Mo.

The number of municipalities in the United States issuing permanent bonds and the number of separate issues made during June, 1923, were 390 and 550 respectively. This contrasts with 394 and 571 for May, 1923, and 560 and 762 for June, 1922.

Of the fifty-odd representative bond issues included in the tabulation on this page 3 sold at par, 46 above par, and 3 below par. The yields ranged from 4.11 to 5.97 and the rate of interest from 4¼ to 6 per cent.

REPRESENTATIVE PUBLIC BOND SALES DURING JUNE AND JULY, 1923

State	Purpose	Amount	Rate Per Cent	Sold for	Basis	Dated	Maturity	Purchased By
Colorado	Roads	1,500,000	5	100.61	4.95	June 1, 1923	1934–36	International Trust Co., Denver
County								
Beaufort, N. C.	Roads	150,000	5	100.28	4.97	1923	1929–53	Geo. H. Burr & Co., Chicago
Erie, Ohio	Water impv't.	124,000	5½	100.00	5.50	March 1, 1923	1925–34	State Industrial Commission
Jefferson, Wis.	Roads	600,000	5	104.03	4.58	1923	1933–39	Second Ward Securities Co., Milwaukee
Lucas, Ohio	Roads	542,658*	5	100.27	4.94	1923	1924–32	R. M. Grant & Co., Chicago
Montgomery, Ohio	Sewer	228,000	5½	104.93	4.95	1923	1926–45	Federal Securities Corp., Chicago
Pike, Ind.	Roads	30,000	5	102.66	4.45	May 15, 1923	1924–33	First National Bank, Winslow, Ind.
Shelby, Tenn.	School and market	975,000	4½	100.08	4.74	June 1, 1923	1933–57	Harris Trust & Savings Bank, Chicago
Charlotte, Fla.	Roads	200,000	6	100.37	5.97	Jan. 1, 1923	1929–52	G. B. Sawyers Co., Jacksonville, Fla.
Hennepin, Minn.	Hospital	750,000	4½	101.61	4.57	July 1, 1923	1928–42	Bankers Trust Co., New York and others
Person, N. C.	Roads	15,000	5	100.16	4.99	May 1, 1923	1929–43	L. S. Rosenthal Co., Cincinnati
Randolph, Ind.	Roads	118,700	5	100.61	4.88	May 15, 1923	1924–33	Merchants National Bank, Muncie, Ind.
Atlantic City, N. J.	Building	136,000	5	102.95	4.65	July 1, 1923	1925–43	Bankers Trust Co., Atlantic City, N. J.
Broward, Fla.	Roads	200,000	6	102.58	5.76	Jan. 1, 1923	1932–46	Lauderdale State Bank
Burlington, N. J.	Roads	221,000	5	101.85	4.61	Aug. 1, 1923	1924–33	M. M. Freeman & Co., Phila.
Cayuga, N. Y.	Court house	150,000	4½	100.31	4.38	May 1, 1923	1924–28	Lamport, Barker & Jennings, New York
Hardin, Ohio	Roads	34,000	5½	100.11	5.47	June 1, 1923	1924–32	Sidney, Spitzer & Co., Toledo
Lake, Ohio	Sewer	170,000	5	100.31	4.96	April 1, 1923	1925–42	Richards, Parish & Lamson, Cincinnati
Lucas, Ohio	Road	296,111	6	103.51	5.21	July 2, 1923	1924–32	Syndicate, Sidney Spitzer & Co., Toledo, and others
Los Angeles, Cal.	Pub. impv't.	1,250,000	5	103.17	4.68	July 1, 1923	1928–47	Bank of Italy, San Francisco
Township								
Independence, Pa.	School	51,000	4½	100.19	4.21	May 1, 1923	1926–30	E. H. Rollins & Sons, Phila.
Municipality								
Ansonia, Conn.	Municip. impv't.	200,000	4½	102.26	4.23	June 15, 1923	1924–43	Thompson, Fenn & Co., Hartford, Conn.
Conrad, Ia.	School	150,000	4½	100.70	4.70	June 1, 1923	1928–43	Ringheim, Wheelock & Co., Des Moines, Ia.
Geneva, N. Y.	School	480,000	4½	100.45	4.22	June 1, 1923	1926–63	Harris, Forbes & Co., New York and others
Green Bay, Wis.	School	600,000	4½	102.10	4.25	July 1, 1923	1924–43	First Trust & Savings Bank, Chicago
Greenville, S. C.	School	240,000	5	100.81	4.92	July 1, 1923	1924–47	A. M. Law & Co., Spartanburg, S. C.
Manchester, N. H.	Bridge	300,000	4	97.07	4.12	May 1, 1923	1924–43	P. F. Cusick & Co., New York
Memphis, Tenn.	Municip. impv't.	1,527,000	4½–5	100.08	4.78	July 1, 1923	1926–63	Syndicate, Bankers Trust Co., New York and others
Miami Beach, Fla.	Pub. impv't.	220,000	5½	99.55	5.81	April 1, 1923	1925–43	First National Bank of Miami, Fla.
Milwaukee, Wis.	Pub. impv't.	4,390,000	4½	100.63	4.43	July 1, 1922	1923–42	Syndicate, Wells-Dickey Co., Minneapolis, and others
Perth Amboy, N. J.	School	248,000	4½	101.12	4.66	July 1, 1923	1925–63	First National Bank, Perth Amboy, N. J.
Seattle, Wash.	Port impv't.	100,000	5	99.64	5.03	June 1, 1923	1924–65	Bond, Goodwin & Tucker, Seattle
Spring Lake, N. J.	Streets	80,000	5	101.05	4.87	Feb. 1, 1923	1924–43	Boland & Preim, New York
Troy, N. Y.	Pub. impv't.	276,000	4½	100.88	4.15	July 1, 1923	1924–43	Geo. B. Gibbons & Co., New York
Wauwatosa, Wis.	Sewer	30,000	5	102.67	4.71	June 15, 1923	1924–43	Harris Trust & Savings Bank, Chicago
West Orange, N. J.	Sewer and street	83,000	4½	100.10	4.49	June 1, 1923	1925–43	H. L. Allen & Co., New York
Williamsport, Pa.	Sewer	100,000	4½	101.07	4.19	July 1, 1923	1953	Stroud & Co., Phila.
Akron, Ohio	Water, grade elim.	1,075,000	4½	100.91	4.67	July 1, 1923	1924–52	Grau, Todd & Co., Cincinnati
Blanchester, Ohio	School	75,000	5½	103.66	5.10	June 21, 1923	1924–47	Detroit Trust Co., Detroit
Cleveland, Ohio	School	700,000	4½	100.00	4.50	July 1, 1923	1924–43	Syndicate, Eldredge & Co.
Denver, Colo.	Moffat Tunnel	6,720,000	5½	103.20	5.33	1923	1943–63	R. M. Grant & Co.
Greenfield, Mass.	Street and water	120,000	4½	101.15	4.11	July 1, 1923	1924–43	First National Bank, Greenfield, Mass.
Greensboro, N. C.	Streets	1,000,000	5	100.00	5.00	Jan. 1, 1923	1925–44	Syndicate, Kauffman-Smith-Emert & Co. and others
Greensboro, N. C.	Water	300,000	5	100.08	4.99	Jan. 1, 1923	1925–64	Syndicate, Kauffman-Smith-Emert & Co., and others
High Point, N. C.	Pub. impv't.	834,000	5½	100.10	5.24	April 1, 1923	1932–48	Commercial National Bank, High Point, N. C.
Monticelo, Ind.	Water	25,000	5	101.50	4.76	June 1, 1923	1925–36	Union Trust Co., Indianapolis
Norfolk, Va.	Water	410,000	5	104.64	4.71	May 1, 1922	1952	Syndicate, Kissel, Kinnicutt & Co., and others, N. Y.
Oneonta, N. Y.	Water	217,000	4½	100.19	4.46	June 15, 1923	1924–33	Union National Corp., New York
Washington, Cal.	School	150,000	5	101.68	4.82	June 15, 1923	1924–48	Blyth, Witter & Co.
Blasdell, N. Y.	Sewer	39,719	4½	101.28	4.64	July 1, 1923	1928–52	Farson Son & Co., New York
Lima, Ohio	Paving	566,300	5½	100.82	5.33	April 1, 1923	1924–32	Prudden & Co., Toledo
St. Louis, Mo.	Pub. impv't.	2,500,000	4½	101.17	4.38	July 1, 1923	1928–43	Syndicate, Geo. H. Burr & Co., New York, and others
San Diego, Cal.	Pub. impv't.	920,000	5	100.10	4.99	July 1, 1923	1924–63	Bank of Italy, San Francisco

*Ten issues.

Indianapolis Profits By Asphalt Price War

A "war" between asphalt street paving contractors has caused prices for asphalt paving quoted to the Indianapolis board of public works to drop sharply in the last few weeks until the price of $2.30 a square yard was reached on one project, the lowest quotation on asphalt street paving since 1916, according to John L. Elliott, city civil engineer.

At the first of the season, the prices for asphalt paving started around $3.20 a square yard. Later the price hovered about $3.00, and about three weeks ago a sharp drop to about $2.60 was noted. Thie was followed by the $2.30 offer.

Cement Production Ahead of Last Year's Output

Portland cement production in the United States during June, based on figures issued by the Department of the Interior and prepared under the direction of Ernest F. Burchard, of the U. S. Geological Survey, from reports of producers, amounted to 12,382,000 bbl., as compared with 11,245,000 bbl. for June, 1922. The shipments for June of this year and last year were, respectively, 13,307,000 and 13,470,000 bbl., and stocks were respectively 9,219,000 and 10,718,000 for the same period.

For the first six months of this year the production of portland cement was 62,320,000 bbl. a gain of 15,402,000 bbl. over the same period of 1922.

Large Contracts Let During Week

Among the week's announcements of contracts awarded in Construction News, pp. 29 to 41, are the following:

Hotel, Cleveland, O., to Crafts Construction Co., $3,000,000.

College buildings, Greenville, N. C., to J. E. Beaman Construction Co., Raleigh, $1,025,000.

Bank and office building, Boston, Mass., to A. C. Whitney, $1,000,000.

Bids Wanted on Big Jobs

Among the projects on which bids are either asked or will soon be called for, in Construction News, pp. 29 to 41, are the following:

Factory, Sweetwater, Tex., for United States Gypsum Co., $1,000,000.

Cement plant, Macon, Ga., for Clinchfield Portland Cement Co., Kingsport, Tenn., $1,000,000.

Hospital, Nashville, Tenn., for Vanderbilt University, $2,000,000.

Cement plant, Jefferson City, Mo., for State Highway Commission, $2,000,000 to $2,500,000.

High school, Hartford, Conn., for Board of Contr. and Supply, $1,500,000.

Jetty, New Orleans, La., for U. S. Engineer, $1,300,000.

Railways Continue Record Loading of Revenue Freight

Despite the fact that loading of revenue freight for the week which ended on June 30, according to the Car Service Division of the American Railway Association, totaled 1,021,770 cars, the greatest number for any one week in the history, the railroads of the United States had on June 30 a total of 63,636 surplus freight cars in good repair. This is in contrast with the situation that existed during the week of Oct. 14, 1920, when 1,018,539 freight cars were loaded, the best previous loading record, at which time there was a car shortage of 69,517 cars.

Despite the fact that the loading of revenue freight for the month of June has averaged more than 1,000,000 cars a week, the greatest in history for this time of year, there was an actual increase during the month of June of 31,193 in the number of surplus freight cars. Despite this heavy traffic no car shortage has existed.

Weekly Construction Market

THIS limited price list is published weekly for the purpose of giving current prices on the principal construction materials, and of noting important price changes on the less important materials. Moreover, only the chief cities are quoted.

Valuable suggestions on costs of work can be had by noting actual biddings as reported in our Construction News section.

The first issue of each month carries complete quotations for all construction materials and for the important cities. The last complete list will be found in the the issue of July 5; the next, on Aug. 2.

Steel Products:	New York	Atlanta	Dallas	Chicago	Minneapolis	Denver	San Francisco	Seattle	Montreal
Structural shapes, 100 lb.	$3.64	$4.30	—$4.20	$3.40	$3.55	$4.20	$3.60	$4.10	$4.25
Structural rivets, 100 lb.	4.40	5.00	—4.90	3.75	4.25	5.40	5.00	4.75	6.00
Reinforcing bars, ¾ in. up, 100 lb.	3.54	4.25	3.80	—3.20	3.45	3.85	3.50	4.10	4.00
Steel pipe, black, 2½ to 6 in. lap, discount	44%	52%	45%	47%	53–5%	36%	35.2@47.6%	40%	32.76
Cast-iron pipe, 6 in. and over, ton	62.30	58.00	63.00	60.20	60.50	69.00	62.00	70.00	60.00
Concreting Material:									
Cement without bags, bbl.	2.80	2.85	2.25	2.20	2.50	2.84	2.63	2.90	2.25
Gravel, ¾ in., cu.yd.	2.25	1.90	2.25	2.00	1.85	1.90	2.15	1.25	1.50
Sand, cu.yd.	1.25	1.24	1.95	2.00	1.25	1.00	1.50	1.25	1.25
Crushed stone, ¾ in., cu.yd.	1.75	2.00	2.50	2.00	2.25	3.50	2.15	3.00	1.90
Miscellaneous:									
Pine, 3x12 to 12x12, 20 ft. and under, M.ft.	63.00	42.00	+52.75	58.50	—42.50@ 44.75	—47.00	41.00	31.00	70.00
Lime, finishing, hydrated, ton	18.20	23.50	22.00	20.00	25.50	24.00	22.00	24.00	21.00
Lime common, lump, per bbl.	3.00@3.25	1.50	2.35	1.50	1.50	2.70	2.10	2.80	10.00
Common brick, delivered, 1,000	23.50@24.60	14.00	13.10	11.00	17@19	12.00	15.00	13.00	16.50
Hollow building tile, 4x12x12, per block	Not used	.109	.115	.0724	.0816	.065	.....	.11	.115
Hollow partition tile 4x12x12, per block	.1573	.109	.115	.....	.....	.065	.108	.11	.....
Linseed oil, raw, 5 bbl. lots, gal.	—1.10	1.20	—1.30	1.28	—1.18	1.34	—1.23	.86	1.38
Common Labor:									
Common labor, union, hour	.75	.35	.....	.....	.....	.50@.55	.55	.....	.....
Common labor, non-union, hour	....	.30	.30@.50	.82½	.55	.35@.50	.50	.50@.62½	.30@.35

Explanation of Prices—Prices are to contractors in carload lots unless other quantities are specified. Increases or decreases from previous quotations are indicated by + or — signs. For steel pipe, the prevailing discount from list price is given: 45-5% means a discount of 45 and 5 per cent. Charge is 15c. per 100 lb. for cutting reinforced steel into 2-ft. lengths or over.

New York quotations delivered, except sand, gravel and crushed stone, alongside dock; common lump lime, in 280-lb. bbl. net, and hydrated lime f.o.b. cars; tile "on trucks"; linseed oil and cast-iron pipe f.o.b.

Labor—Concrete laborers' rate, 93¾c.; building laborers (pick and shovel men) 75c. per hr.

Chicago quotes hydrated lime in 50-lb. bags; common lump lime per 180-lb. net. Lumber delivered on job.

Minneapolis quotes on fir instead of pine. Brick, sand and hollow tile delivered. Cement on cars. Gravel and crushed stone quoted at pit. We quote on brown lime per 180-lb. net; white is $1.80 for Kelly Island and $1.70 for Sheboygan. Common labor not organized.

Denver quotes on fir instead of pine. Cement "on tracks"; gravel and sand at pit; stone on cars; lime, brick, hollow tile and lumber on job. Tile price is at warehouse. Linseed oil, delivered, in iron bbl. Common lump lime per 180-lb. net.

Atlanta quotes sand, stone and gravel per ton instead of cu.yd. Common lump lime per 180-lb. net.

Dallas quotes lime per 180-lb. bbl. Steel, cement, cast-iron pipe and crushed stone f.o.b. cars, other materials delivered.

San Francisco quotes on Heath tile, size 5½ x 8 x 11½. Prices are all f.o.b. warehouses except C. I. pipe, which is mill price plus freight to railway depot at any terminal. Common lump lime per 180-lb. net. Lumber prices are to dealers in yards at San Francisco, for No. 1 fir common.

Seattle quotes on Douglas fir (delivered) instead of pine. Lump finishing lime per 180-lb. net. Hollow building tile delivered. Hydrated lime in paper sacks. Sand and gravel at bunkers.

Montreal quotes on pine lumber. Sand, stone, gravel and lump lime per ton. Cement, lime and tile are delivered; sand, gravel and stone on siding; brick f.o.b. plant; steel and pipe at warehouse. Hollow tile per ft. Cement price is in Canadian funds (the Canadian dollar stands at 97.32). Bag charge is 80c. per bbl. Discount of 10c. per bbl. for payment within 20 days from date of shipment. Steel pipe per 100 ft. net; 2½-in., $32.76; 6-in., $108.

Changes Since Last Week

While prices of certain basic materials have shown a downward trend during the last two months, increased labor costs have offset any gains realized by the buyer. Lumber has dropped materially; premiums charged for quick steel deliveries have disappeared from the market, and such materials as lead and linseed oil have declined with the decrease in demand. Brick, however, has advanced owing to scarcity, while cement has remained fairly firm throughout the entire country. The general tendency of the present market, therefore, appears to be toward stabilization at present levels rather than an actual decline.

Pig-iron prices have gradually fallen off, owing to unsettled market conditions and slowness of buying. A fair-sized volume, however, of new steel plate inquiries, for tank and car construction, marks the beginning of the third quarter.

While pig-iron, coke and scrap are lower, there has been no deviation from the $2.50 base on plates and shapes. Reinforcing bars are still $2.40 per 100 lb., f.o.b. mill. A fair volume of new demand for structurals has also developed, with a slight slowing down in production, owing to labor shortage and weather conditions.

Steel shapes dropped 10c. and structural rivets 5c. per 100 lb. in Dallas, while reinforcing bars declined 12½c. in Chicago warehouses during the week. Pine timbers rose 50c. in Dallas and Douglas fir declined $1 per M. ft. in Denver. Linseed oil dropped 1c. in San Francisco, 2c. in Dallas, 3c. in New York and 6c. per gal in Minneapolis.